Contractors and Engineers Monthly

Vol. 36, No. 9 SEPTEMBER, 1939 $2 a Year, 20 Cents a Copy

Highlights Of This Issue

- **Daylighting a Tunnel**
  The replacing of an old tunnel by an open cut, involving the removal of about 500,000 cubic yards of material, was complicated by a series of slides which added about 300,000 more yards to be removed on a highway widening job near Newhall, Calif.
  See page 2.
- **Features of Overpass Job**
  The construction of an 1,305-foot overpass to take care of additional traffic from the Galveston causeway in Texas was featured by the foundations, form work, and simple attractive design of the structure.
  See page 2.
- **Highway Maintenance Depots**
  The layout and equipment of a typical Indiana State Highway Department maintenance depot and the work carried on there are described in this issue.
  See page 5.
- **Road-Mix and Sand-Clay Bases**
  On a 28-mile paving contract in South Carolina, 11 miles were road-mix base with single bituminous surface treatment without prime and 17 miles were sand-clay base with double bituminous surface treatment of the primed base.
  See page 7.
- **Low-Cost County Roads**
  The methods used by Kent County, Mich., for rebuilding old road bases and placing gravel wearing surfaces to be used later as the bases for black-top surfacing are described in this issue.
  See page 11.
- **Levee Built by Dredge**
  The dredge G. A. McWilliams, recently converted from diesel to steam power, was used by the U. S. Engineer Department for levee work at Glasscock Cut-Off on the Mississippi River.
  See page 16.
- **Unusual Bridge Job**
  The swiftness of the current and the tides in an arm of Puget Sound, near Tacoma, Wash., necessitated some unusual methods in the construction of the 5,939-foot Narrows Bridge, including open dredge caissons anchored by huge blocks of concrete.
  See page 26.

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A Cleared Section of Route 23 Which Crosses the Northern Part of New Jersey Where the Country Is Hilly

New Jersey Roads Open All Winter

Dense Population, Heavily-Traveled Roads, Variation In Snowfall, Problems Met By State Highway Dept.

By R. G. SKERRETT

✦ EACH winter New Jersey is confronted with a task fraught with many uncertainties in the matter of removing snow from its main highways and in controlling ice upon those much traveled routes so that they may be available and safe for use, as far as practicable, the season through.

The primary state highway system of

(Continued on page 18)

Preparing Aggregates At Marshall Ford Dam Near Austin, Texas

(Photo on page 40)

Contractors Used Mining Equipment, with Conveyor Belts and Aerial Tramway To Transport Aggregates

✦ THE preparation of the aggregates for the million yards of concrete required for the first stage of Marshall Ford Dam 18 miles by road northwest of Austin, Texas, is one of the many interesting features of this flood control, power and reclamation project. Construction of the dam is in two stages. The plan for the ultimate development provides for a concrete gravity dam with a maximum height of 270 feet above the lowest part of the foundation and a crest length of 2,700 feet. A rolled earth embankment with a maximum height of 105 feet and a crest length of 2,400 feet flanks the left end of the dam and will be protected by a rock face on the upstream and downstream slopes. The spillway, located in the river channel, is of the ogee type with an effective length of 700 feet at Elevation 714. The capacity of the spillway is figured to be 508,000 second-feet with the water at Elevation 746.

Twenty-four flood control outlets at Elevation 540 are each 8½ feet in diameter and are constructed through the overflow section of the dam. They have a capacity of 126,000 second-feet with the water at Elevation 714. The plans for the high dam contemplate the construction of a power plant of three 20,000-kw generators.

The first stage of development, now practically completed, is the gravity dam to a height of 190 feet, a crest length of 2,285 feet and the rolled earth embankment to a maximum height of 35 feet and a length of 1,100 feet. The ogee spillway is 730 feet long at a crest elevation of 640 feet and has a capacity of 480,000 second-feet with the water level at 670 feet. The twenty-four flood control outlets are completed as a part of the low dam. To provide for future power development, three penstocks each 16 feet in diameter are installed in the low dam. One penstock is temporarily capped at the outlet end and two are closed at the upstream by two Broome gates. It is expected that the Lower Colorado River Authority will install two power units to develop the power with the low dam.

The following table shows some of the quantities of construction materials required for the low and high dams as well as the storage capacities of the two dams:

	High Dam	Low Dam
Concrete, cubic yards	1,945,000	910,000
Embankment, cubic yards	1,467,000	67,000
Rock fill, cubic yards	250,000	15,000
Storage capacity (acre-feet)		
Superstorage for flood control	1,160,000	454,000
Live storage for flood control	990,000	0
Live storage for flood control and power	630,000	323,000
Live storage for power	620,000	150,000
Dead storage for power	120,000	160,000
Total storage	3,120,000	977,000

(Continued on page 34)

Changes in Making Nominations For Roadside Development Awards

✦ TWO important changes have been made in the regulations governing the nominations for the CONTRACTORS AND ENGINEERS MONTHLY Annual Roadside Development Awards. The first change is concerned with the number of nominations which may be made. Instead of limiting the number to not more than three from each state, as originally announced, we are inviting the state highway departments to submit as many nominations as they wish. This will relieve them of the task of selecting the outstanding contributions made on their projects and will, we hope, give a wider scope to the competition.

Due to the fact that more nominations than originally announced may be submitted, the date on which the nominations must be mailed has been extended to October 1. Nomination blanks have been sent to all the state highway departments and we urge that they begin now, if they have not already done so, to prepare the nominations, in order to be sure that they are ready for mailing on the closing date.

We also urge contractors to aid the state highway departments by submitting to their resident engineers or to the main state highway office the necessary data on any roadside development work involved in their contracts this season so that they may be eligible for the Awards.

The Editorial Staff of CONTRACTORS AND ENGINEERS MONTHLY will select not more than three nominations from each state to be delivered to the judges for the four Sectional Awards, one for the North Atlantic States, one for the Central States, one for the Southern States, and one for the Western States. The four winners of the Sectional Awards will receive plaques as testimonials of their outstanding contributions to roadside development in their respective sections of the country, and one of the Sectional Award winners will be the recipient of the National Award, a silver loving cup, as evidence of the most outstanding contribution to roadside development made by a contractor in the United States during the 1939 construction season. These Awards will be made at the American Road Builders' Association Convention in Chicago next January.

C. & E. M. Photo

The Tramway Loading Station, With Loaded Bucket 52 Starting Out and Bucket 50 Returning Empty

Progress of the Excavation of the 200-Foot Cut and the Removal of Slides at the Newhall Tunnel on U. S. 99 in the Sierra Madre Mountains Northeast of Los Angeles, Calif., from July 22, 1938, to November 14, 1938, When the Last of the Tunnel Was Being Removed. This Series of Photographs Was Furnished by the California Division of Highways.

Old Tunnel Daylighted, Earth Slides and Paving

Newhall Tunnel Removed, Cut Widened by Griffith; Huge Slides Delayed the Completion of Project

(*Photos on page 40*)

✦ EVER-INCREASING traffic into the San Joaquin Valley through the passes in the Sierra Madre mountains northeast of Los Angeles made it necessary to widen the existing 20-foot asphaltic concrete pavement on U.S. 99 toward Newhall. This made the old Newhall Tunnel a bottleneck. To widen the tunnel would cost more than the improvement justified so it was decided to daylight the tunnel by an open cut involving the moving of about 500,000 cubic yards of fairly easy material. The contract was awarded to Griffith Co. of Los Angeles, Calif., for excavation, removal of the tunnel, and paving the new section of the highway. The various difficulties encountered make a story of unusual interest.

Original Excavation

To daylight the tunnel required a cut 200 feet deep involving about 250,000 cubic yards of excavation. The early excavation at the tunnel was handled by two Northwest 2½-yard shovels with Amsco buckets loading to Mack trucks with 10-yard steel bodies. A pair of tractors and bulldozers was run up the fire trail to the top of the cut and material was pushed down to a uniform elevation where the shovels worked almost continuously as will be seen by the series of photographs of the work in the original cut over the tunnel. The shovels were worked on about 10 feet of cover on the tunnel with the portal extended with wooden sheeting. Traffic was allowed to use the tunnel.

The first slides began when the shovel was still about 20 feet above the tunnel in September 1938. This made it necessary to stop traffic and detour it.

Handling the Slides

While the slide material that had to be removed amounted to a total of about 300,000 yards, the individual slides amounted to masses from 1,000 to 5,000 yards with one large block about 40,000 yards in volume. The original slope of the cut was ½ to 1 on the side where the slides started but the slides carried this down to 2 to 1 or flatter.

To lighten the load at the top of the cut where the slides started the State secured permission to dump some material over into the small canyons away from the road. The contractor put in a couple of bulldozers and pushed 45,000 to 50,000 yards of material amounting to over 60 feet in height over into the canyons out of the way. One slide amounted to about 40,000 yards and remained intact so that it could not safely be bulldozed down the slope for the shovels to handle. It was feared that the mass would tip up and leave a vertical face in front as it started to do when the usual bulldozing operation was begun. This somewhat cemented material was therefore blasted with some shots of Trojan explosives to break it up for the shovels.

A small slide outside the tunnel area just slipped down about 20 feet with the top surface as level as it was before the slide. To relieve the load of this slide it was necessary to pull a ripper over the top to break it up before it could be bulldozed down to the shovels. The hauls for disposing of the excess material from the slides varied from ¼ mile up, with an average of 1 mile. The material from the original cut was nicely balanced with a long fill to the northeast but the State had to get additional areas for the spoil piles from the slides.

Throughout the work in both original excavation and handling the slides the contractor managed to have trucks on both sides of the shovel so that there was no lost time in waiting for a truck to be spotted at the shovel. This was aided somewhat by the fact that the cuts started 20 feet outside the highway, leaving some space for the maneuvering of the trucks. The two Northwest shovels worked two shifts of 6 hours and 20 minutes each, moving 4,000 yards per day. The slide material was handled by the contractor at an adjusted price of 15 cents per cubic yard for material wasted in canyons and 23 cents for material loaded and hauled in trucks.

Other Troubles

On this 3.7-mile contract it was thought that the slides were enough trouble for the contractor, but that was not the case. In one spot it was necessary to plug an abandoned oil well right in the middle of the new right-of-way. This required a lot of negotiating by the Division of Highways because such practice is standardized by another state department, and of course, there were the damages from the loss of the well permanently to be taken care of.

C. & E. M. Photo
A Cascade of Solid Earth Speeds Work on the Newhall Tunnel Job

Right where there was a 30-foot fill a 4-acre swamp showed up, totally unsuspected before an RD8 tractor did a nose dive into it. It was decided that if the fill displaced the material, the toe would be surcharged by a false berm, a practice that has been very successful in other work of a similar nature in California. Much to everybody's surprise

(*Concluded on page 8*)

Galveston Overpass For Causeway Traffic

Concrete Structure Built On Pile Foundations; Features Are Attractive Design and Good Forms

(*Photo on page 40*)

✦ THE completion of the new Galveston, Texas, causeway created a larger volume of traffic to the island city and thus magnified the hazard of the crossing at grade of the two tracks of the Gulf Colorado & Santa Fe Railroad at Virginia Point. The Austin Bridge Co. which with the Austin Road Co. recently completed the causeway was awarded a contract and started work July 28, 1938, on the attractive overpass 1,305 feet in length with 5 per cent grades and a vertical curve at the top. Features of the job were the design, simple attractive architectural treatment, foundations, form work and the uniform hand-rubbed finish of the completed structure.

Design

The overpass consists of five spans of 45 feet ⅜ inch over the existing two railroad tracks and an anticipated new track, thirteen 40-foot spans on the north end and fourteen similar spans at the south end. The foundation for a typical bent for the 40-foot spans consists of three separate footings, one for each of the columns. The center footings are 3 feet 6 inches high and 10½ feet square while the outer footings are 2 feet 9 inches high and 5½ x 8 feet. The three footings are entirely independent but the bottoms of the three footings in one bent are at the same elevation. The footings rest on pile foundations of sixteen piles for the center and six each for the outer footings in the bent. The piles extend 1 foot into the footings and run from 26 to 36 feet in length, measuring 8 inches at the tip and 12 inches at a distance of 4 feet from the butt. They were driven with a No. 2 Vulcan hammer in 50-foot leads. The piling is all untreated pine.

Nine inches above the top of the outer footings, on all except the footings at the railroad tracks, is a tie beam 2 feet 9 inches high and 2 feet thick. The railroad crossing bents are skewed with the tracks at an angle of 30 degrees and are slightly larger than the typical footings

(*Continued on page 24*)

C. & E. M. Photo
A Section of the Overpass Near the Galveston Causeway, Completed Except for the Hand Rail

Another important link in U S 1 is paved with TEXACO Sheet Asphalt

U. S. No. 1 stretches from northern Maine to Miami, Fla. It is the principal north-south route in the great fabric of U. S.-marked highways.

For the heaviest concentrations of traffic on U. S. No. 1, look for the points where it meets important cities. For example, where it skirts the city of Philadelphia.

Under the combined tourist and local traffic of U. S. No. 1 at Philadelphia, heavy-duty TEXACO Sheet Asphalt paving has been laid. Dense, resilient, durable TEXACO Sheet Asphalt has been laid under concentrated traffic throughout the country east of the Rockies for thirty years. It has demonstrated conclusively time and again its admirable fitness for such service.

Write for copy of our illustrated booklet on "Texaco Sheet Asphalt"

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The County Highway Problem in Federal-State-County Relationships

By JOHN A. LONG, Engineer-Manager,
County Highway Officials' Division, American Road Builders' Association

There seem to be two prominent questions uppermost in the mind of county road officials these days. The first is "Why can't Federal-Aid for secondary and feeder roads be handled directly between the Federal government and the counties?" and the second is "How can local government participate in the administration of the Federal-Aid secondary and feeder road program?"

In my capacity of executive engineer of the County Highway Officials' Division of the American Road Builders' Association, I have had a number of county officials ask if it is not possible to obtain direct Federal-Aid from funds made available under the Federal-Aid secondary and feeder road appropriations, or if it isn't possible to have the Act revised to make Federal-county relations possible. My reply has had to be regretfully negative.

However the lack of direct relationship with the Federal government, or the Public Roads Administration, does not mean that the doors to those benefits are closed to the counties. It may be that one entrance is closed, but there are other means of securing these benefits. And as long as the net result is the receipt of Federal Aid or any other aid which supplements local funds and advances local road improvement, the agency through which these benefits come does not seem of primary importance.

There are three prominent agencies, under our form of government, charged with highway construction — Federal, state and county. All three have the power to provide funds for this purpose. The Federal government, however, has offered to share its funds with both the states and the counties, but for administrative reasons has stipulated that these funds must come to the counties through the states. And since this is so, we actually have a system of Federal-to-state-to-county aid. Logically, if the Federal agency says it will act only with the states, then the counties must direct their attention to the states, and a working relationship must be established and maintained that will develop between states and counties the same kind of cooperative effort which has been in effect between the Federal and state governments for many years. Thus will be closed the triune of Federal-state-county unity

(Concluded on page 9)

Utah Sees the Need To Revise Markings

To the Editor
CONTRACTORS AND ENGINEERS MONTHLY

The Utah State Road Commission has been anxiously watching the development of highway center-line markings in other states, and is mindful of the fact that a revision in its marking procedure is necessary.

At present the State Road Commission requires that center lines be painted with a 4-inch solid line on all sections where passing is not prohibited. No-passing zones are indicated by a double stripe, each line of which is 3 inches in width and separated by a 4-inch space. The double center stripe is used at the following locations:

1. On 2 and 3-lane roads over the crest of a hill where the sight distance is less than 800 feet.

2. On 2 and 3-lane roads on all curves having a radius less than 600 feet and on that portion of any curve where the sight distance is less than 800 feet.

3. For the center line of undivided 4 or 6-lane highways.

Results from this type of marking have not proved entirely satisfactory because motorists are not allowed to cross the double line even if the road ahead has sufficient sight distance, such as the down-grade side of a hill. Enforcement of such a restriction is practically impossible.

Since a considerable mileage of the state highway system is not being painted at present, it is hoped that a more inexpensive method can be adopted which will allow for painting a greater mileage. With this in mind, some consideration has been given to the adoption of standards which will require a single dashed line composed of 10-foot dashes and 15-foot spaces on areas of adequate sight distance. No-passing zones would then be indicated by a solid line parallel to the dashed center line and in the lane where passing is prohibited.

It is believed that such a procedure will allow the painting of more highways, as well as accomplishing the purpose of center-striping on no-passing zones.

R. W. Groo,
Salt Lake City, Utah — Safety Engineer
August 8, 1939

"Still Wet, Huh?"

During the period from 1925 to 1936, when the number of registered motor vehicles increased from 20,000,000 to 28,000,000, an increase of 40 per cent, the gasoline used increased by 110 per cent, and the average annual use of gasoline per registered motor vehicle increased from 430 gallons to 638 gallons, or approximately 48 per cent over the 1925 average.—*Robert B. Brooks, St. Louis.*

VIEWS OF A TYPICAL MAINTENANCE DEPOT OF THE INDIANA STATE HIGHWAY DEPARTMENT

1. A Portion of a Subdistrict Headquarters, Showing Two Sheds and a Bituminous Storage Tank. 2. The Physical Plant, Located on a Plot of About 3 Acres, Allowing for Effective Landscaping As Well As Ample Storage Space. 3. The Superintendent's Office in the Headquarters Building. 4. The Equipment Paint Room, Showing a Truck Being Cleaned in Preparation for Painting. 5. The Sign Room Where Road Markers and Signs Are Refinished and Repainted. Note the Neat Enclosed Shelves for Stocking Signs and Tools. 6. The Service Room, Showing the Work Bench and Some of The Equipment Used. See Page 5.

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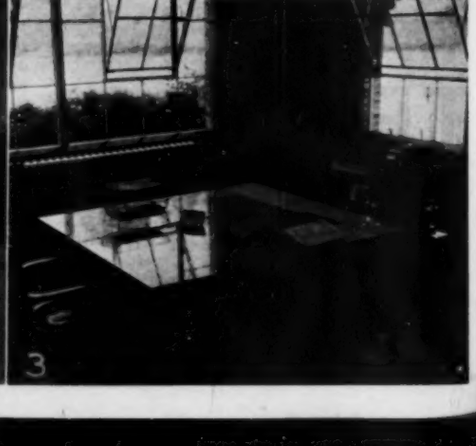
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Maintenance Depots For Indiana Highways

Well-Planned Subdistrict Headquarters Serve About 250 Miles of Roads, Store Equipment and Materials

By N. F. SCHAFER, Engineer of Maintenance, State Highway Commission of Indiana

(*Photos on page 4*)

✦ IN Indiana, a typical State Highway Commission decentralized maintenance depot is called a subdistrict headquarters and is a complete unit for the repair and painting of equipment, the storage of equipment, storage of bituminous materials for center-line marking and patch work, storage of bituminous mixtures for patch work, and the repair of road markers and signs. A superintendent controls and directs the work at the headquarters and the maintenance of 250 miles of state highways in an area of approximately two counties.

The physical plant is located on a tract of land approximately 3 acres in area, large enough for the necessary building, effective landscaping, storage sheds, storage tanks for bituminous materials, outside storage space for certain pieces of equipment, and space for stockpiles of materials.

The Headquarters Building

The building contains the superintendent's office, a service room for the repair of equipment, a stock room, an equipment paint room, a sign room, boiler room, and fuel room. The sign room, which is over the office and stock room, is the only room on the second floor.

The exterior and interior walls are of concrete to a height of approximately 3 feet 6 inches above the floor. The window sills are of cast concrete and line up with the top of the wall. The masonry starts at the top of the concrete walls. Common brick is used to face the exterior walls and the interior walls are faced with double-brick-size glazed tile. The walls of the front portion are 13 inches thick and the remaining walls, with the exception of the division wall between the service room and the rear portion of the building, are 8 inches thick. Steel sash is used throughout; some glazed with double-strength wire-reinforced glass and others with ⅛-inch rough hammered glass.

With the exception of the sign room, the floors are of monolithic concrete, reinforced with welded wire mesh. The floor of the sign room, on the second floor, is of reinforced concrete slab. The roof is of wood joist construction, with wood sheeting covered by a built-up ten-year-bonded mineral-surfaced roofing material. The roof construction over the service room is supported by bowstring-type steel roof trusses, giving additional ceiling height. The overhead doors are of standard construction.

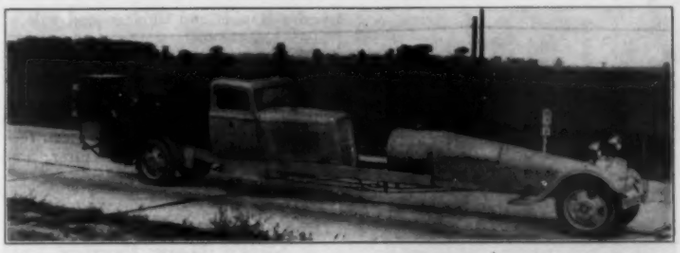
The superintendent's office is equipped with his desk, typewriter, desk for the clerk, conference table, blue-print file and files for correspondence, budgets, requisitions, etc. Battleship linoleum is used as a covering for the concrete floor, and venetian blinds are used at the windows since they have been found to be the most economical and satisfactory sunshade.

The stock room is equipped with modern metal stock bins, racks for moldboards, tires, and brooms. Each stock bin has a card indicating the balance of the particular part or tool on hand. In addition, a master card file is kept, showing the amount and kind of all parts and tools available. This enables the clerk to keep an economical but sufficient amount of stock on hand.

Service and Sign Rooms

The service room is separated from the office, stock room and sign-painting room by kalamein doors in structural steel frames. The doors opening from the service room to the boiler room and equipment paint room are automatic tin-clad fire doors.

The modern equipment in the service room includes an electric valve grinder and refacer, acetylene welding outfit, battery charger of six-battery capacity, drill press, electric blower forge, anvil, air compressor, floor stand emery wheel, automatic pressure grease gun, and overhead cranes. A work bench is located along one wall, under the windows to afford the best lighting conditions. The top of the bench is covered with a heavy metal sheeting for durability. Under the bench are drawers and shelves enclosed by doors which extend from the bottom of the drawers to the floor, for the storage of tools when not in use. Two heavy vises and a small double emery wheel are attached to the work bench.



The Center-Line Marker Used by the Indiana State Highway Commission Has a Long Wheelbase and Is Sufficiently Narrow to Work Without Delaying Traffic

To protect the worker from carbon monoxide gas, a vent flue is built at the end of the service room, with a large opening at the floor line. On top of this flue a 24-inch diameter fan ventilator is installed, controlled from the floor of the service room.

The personnel of this room consists of a shop foreman or chief mechanic, assistant mechanics, a blacksmith, and laborers. The foreman is responsible for the condition of all equipment used within the subdistrict, and makes a periodic inspection of all such equipment so that it will be in good running order at all times.

(*Continued on page 14*)

RUSH ONE MILLION DOLLAR BRIDGE APPROACH
• The Sam W. Emerson Co. are making every move and minute count on their million dollar contract for the west approach to Cleveland's new Main Avenue Bridge. That's why Lorains are on the job—shovels, cranes, clamshells ranging in capacity from ¾ to 1¼ yd. Their work—general excavation, grading, setting steel, handling forms and concrete buckets.
Lorains and the Sam W. Emerson Co., Cleveland, O., have been partners on many big jobs. To date this company has purchased 4 Lorains. Like other big contractors, they have learned that regardless of type or size, shovels and cranes built to Thew Center Drive design move more material, faster, at lower cost.
For complete information, including performance data, on ⅜ to 2½-yd. Lorains, write:
THE THEW SHOVEL COMPANY
LORAIN, OHIO
THEW CENTER DRIVE
LORAINS 3/8 TO 2 1/2 YDS.

Equipped with Two 5-Foot Sickle Bars, This Toro Tractor Mower is One of Several Built to Order for the Connecticut State Highway Department

Special Mower Built For Use on Parkway

The unusual highway mower shown in the illustration is one of several built to order by the Toro Mfg. Co., 3042 Snelling Ave., Minneapolis, Minn., for the Connecticut State Highway Department for use on certain sections of the new Merritt Parkway. The reason for the left and right-hand sickle bars is to enable the machine to operate on the center strip parkway under all traffic conditions.

The tractor on which these two 5-foot sickle bars are mounted is the Toro Bullet model equipped with a 6-cylinder engine and 4-speed transmission, and having a traveling speed of from 3 to 45 mph. The sickle bars are orthodox in construction, but are novel in application due to the fact that they are entirely controlled by power. The bar on the right-hand side is driven by a take-off from the tractor transmission and the left-hand bar is driven by an independent air-cooled single-cylinder motor. Both bars are raised and lowered by power, and controls are through ordinary shift levers. The manufacturer states that either sickle can be raised in 2½ seconds.

Cold-Patch Mixers

CMC portable cold-patch mixers for all types of bituminous repair materials, made by the Construction Machinery Co., Waterloo, Iowa, are now available with a power loader which substantially steps up production, according to the manufacturer. The design of this loader follows that used for many years on CMC concrete mixers.

Other features of these cold-patch mixers include an automatic knockout and skip bumper, single-adjustment band clutch, self-energizing brake, grooved cable spools, renewable abrasion-resisting steel drum liner, automotive steering, anti-friction roller chain and cut sprocket drive, and as optional equipment an Accurmeter calibrated water tank.

These bituminous mixers, which are available in two sizes, 6 and 10 cubic feet with two or four-wheel truck mountings, are described in literature which interested state, county and township highway engineers and contractors may secure direct from the manufacturer or from this magazine.

New Shovel Corporation

Announcement has been made by Alfred Kauffmann, President, Link-Belt Co., Chicago, Ill., of the formation of the Link-Belt Speeder Corp., a wholly-owned but independently operated subsidiary, with headquarters at 301 West Pershing Road, Chicago, for the manufacture and sale of power-operated excavating and material-handling shovels, draglines and cranes, including a full line of track-type locomotive cranes. The organization of this new company follows the consolidation of the Speeder Machinery Corp., Cedar Rapids, Iowa, and the Shovel Division of the Link-Belt Co. The products of the new corporation will be manufactured both at Cedar Rapids and Chicago and will be marketed through a large number of authorized distributors.

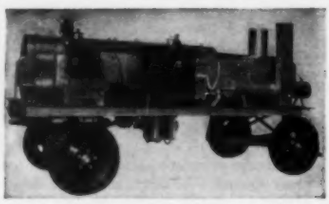
The following officers have been elected: Alfred Kauffmann, Chairman of the Board; T. M. Deal, President; Walter Baker and W. C. Carter, Vice-Presidents; H. E. Kellogg, Treasurer; and G. H. Olson, Secretary.

Snow Plow Equipped With New Power Lift

One of the features of the Hercules Model A snow plow, made by the Hercules Steel Products Co., Galion, Ohio, is the Meyer Electrolift, a new type of power lift in a single compact unit, electrically powered and controlled. The plow lifts in 4 seconds, according to the manufacturer, and may be held at any desired height up to 10 or 12 inches, and may be lowered at any desired speed. Electrolift is quickly and easily installed, with button control close to the driver.

The Model A snow plow is designed for use with 1½ and 2-ton trucks and is of the quick-reversible type, being easily adjusted for right or left delivery or for pushing straight ahead. It has an 8½-foot moldboard, over 24 inches high, and made of 12-gage steel. The A-type pusher frame is of heavy angle construction with tubular underframe mounting, easily attached. Once mounted, the plow may be attached or detached in a few seconds with only two hinge pins. Another feature of this plow is the Meyer Safety Blade, which scrapes directly on the pavement and operates as a safety trip, riding the plow over ordinary road obstructions, according to the manufacturer.

Form 98, describing and illustrating the Hercules Model A snow plow, may be secured direct from the manufacturer or from this magazine.



The RAPID FIRE TANK CAR HEATER

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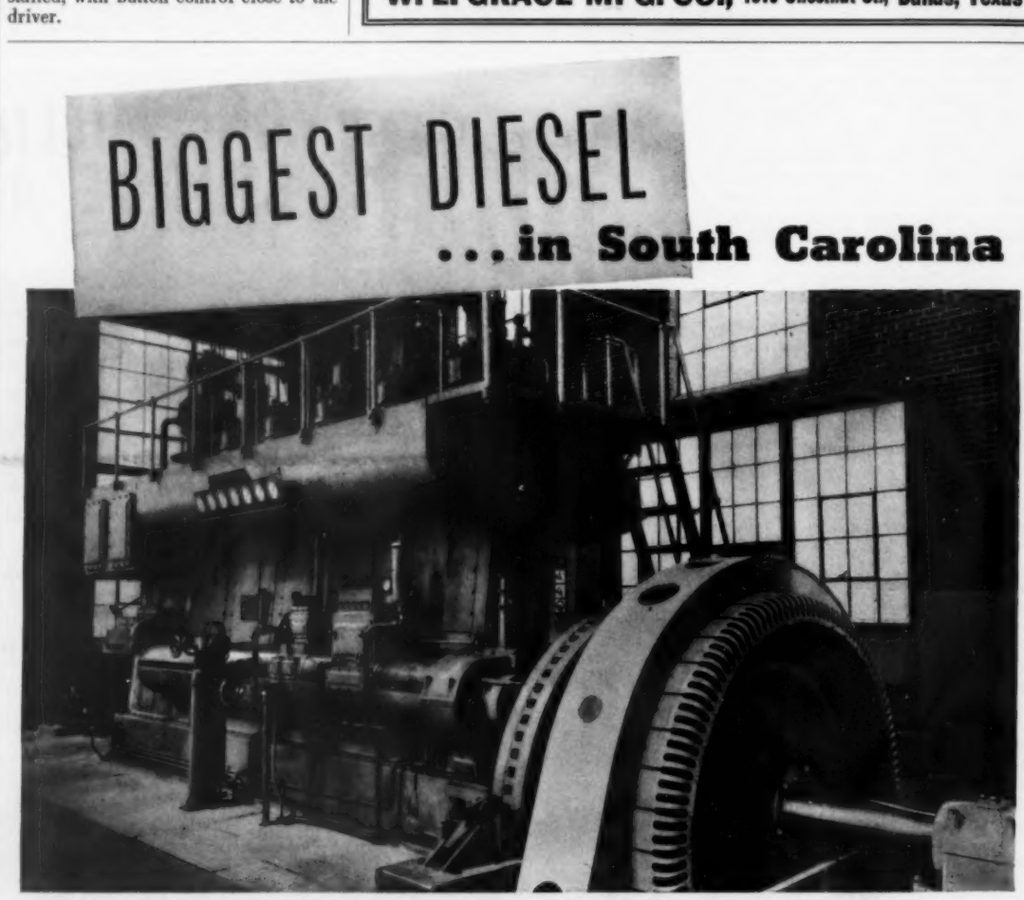
BIGGEST DIESEL ...in South Carolina



NORDBERG 1250 h.p., 2-cycle, air-injection, cross-head constructed Diesel at the Belton plant, installed to handle the increasing loads and supplement present hydro-electric power. Texaco Ursa Oil is the lubricant.

THIS NORDBERG, the largest Diesel engine in the State of South Carolina, is giving an excellent account of itself. It is installed in the plant of the Belton Light & Power Co., Belton, S. C., and operates in parallel with a hydro-plant located miles away.

Since it went into service, this Nordberg has been lubricated with Texaco Ursa Oil.

Chosen by Belton engineers, Texaco Ursa assures a clean engine, freely acting piston rings and valves, ports clear of carbon.

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Sand-Clay and Road-Mix Bases on 28-Mile Contract

MacDougald Constr. Co. Used Road-Mix Machine on An 11-Mile Section of South Carolina Route 31

✦ A 28-MILE paving project on South Carolina Route 31, which runs from Columbia to Charleston, was awarded to the MacDougald Construction Co. of Atlanta, Ga., and completed last summer. The project included 11 miles of road-mix with a single bituminous surface treatment without prime and 17 miles of sand-clay with double bituminous surface treatment of the primed base.

Grading

The new roadbed measures 32 feet shoulder to shoulder and was built up by the contractor, using two Lorain 75 1¼-yard draglines, loading to 27 trucks. Fourteen miles of grading was subbed to J. B. Britton of Sumter, S.C., who used two Northwest draglines and 28 trucks. Normally, shovels would have been used for this service but the pits were wet, making the use of the draglines more acceptable.

On one 3-mile section it was necessary to add sand to the subgrade because the clay ran from 30 to 40 per cent. Approximately 5 inches of sand was spread on the clay subgrade to be used as aggregate for the road-mix since the clay was unsuitable for this purpose.

The Road-Mix Section

For the 11 miles of road-mix the contractor leased a Clyde Wood road-mix machine from the Georgia Bitulithic Co. of Atlanta, Ga. This portable pugmill was pulled by a Model L Allis-Chalmers tractor over the three windrows of road-mix aggregate. The machine has an 8-foot pugmill in a 10-foot housing, with hydraulic jacks to raise and lower the feeding wings at the front, and a spreader bar for controlling the width of the opening of the feeder wings. The pugmill is operated by a power take-off from the tractor. Cut-back asphalt at 110 to 125 degrees F. was supplied by four ¾-inch spray pipes at the head of the pugmill. On the section of the road-mix work where three windrows were used the feeder wing spread was 8 feet and where two windrows were used the wing spread was 11 feet on the 23-foot road.

The mixer operator stood on a grating platform at the rear on which were located hydraulic controls for raising and lowering the wings and for controlling the flow of asphalt. A rotary pump on the rear of the pugmill pulled the cut-back asphalt from a 2,000-gallon tank towed behind. The quantity of asphalt is measured by a Brodie meter between the rotary pump and the four sprays. The road-mix machine is 45 feet long, including the mixer and tank, and 60 feet overall, including the tractor and hitch.

The machine runs 100 feet in 7½ minutes, delivering a well-mixed windrow. The contractor leased this machine for road-mixing the material for the entire 11 miles. Using three windrows, it produced a total cross-sectional area of 17 square feet, which, when spread, was adequate to provide the 5-inch thickness specified. Two windrows gave a cross section area of about 14 square feet which, when spread, lacked about 1 inch of the 5-inch thickness specified. This necessitated additional mixing and hauling of material to the road. The contractor found that, for a thinner surface, the machine was more economical operating on two windrows than blade mixing, but for the extra thickness required on this highway and the use of three windrows the cost of

(*Concluded on page 19*)

C. & E. M. Photo

The Clyde Wood Road-Mix Machine Used by the MacDougald Construction Co.

COMPACT—POWERFUL—SAFE

"For use where power is not practical or available"

Manufactured in 2, 5 and 15-Ton Sizes. For capacity comparison, ½" cable used:

2-Ton "Lightweight" ..... 75 ft.
5-Ton "General Utility" ..... 250 ft.
15-Ton Triple-Geared "Special" ..... 1200 ft.

Patent instant gear change and positive internal brake that never fails, and will lock load. Price, f.o.b.

Gear Ratios	Weight	Seattle
2-Ton 4, & 22 to 1	60 lb.	$ 50
5-Ton 4, & 24 to 1	110 lb.	$ 75
15-Ton 4, 19 & 109 to 1	880 lb.	$250

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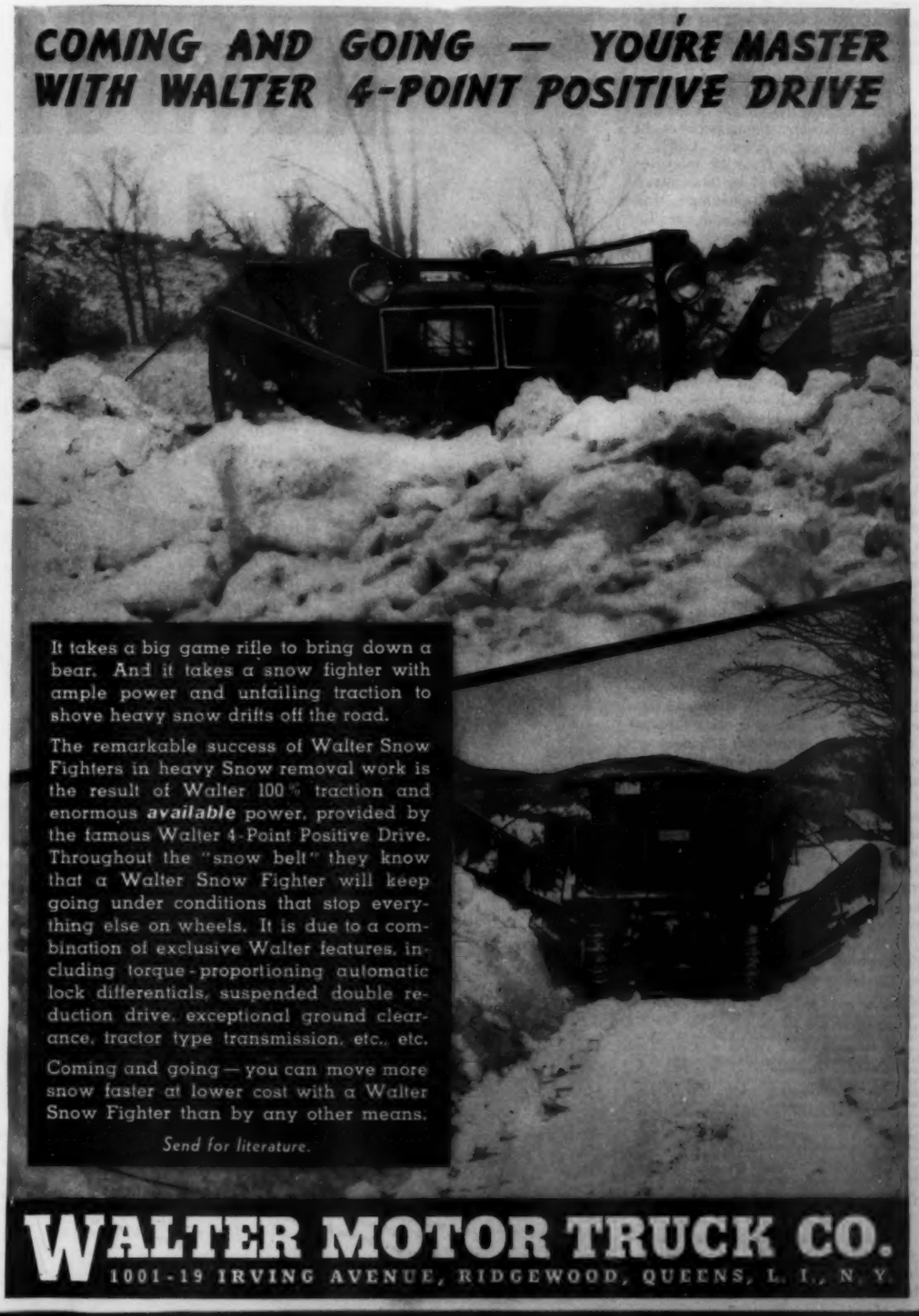
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Tunnel Removed; Road Surfaced with Oil Mix

(*Continued from page 2*)

the fill did not sink nor break the crust on top.

At another point it was necessary to carry a 35-foot fill over the Los Angeles aqueduct on a long-angle crossing where the 10-foot diameter aqueduct in tunnel had only 3 feet cover at that point. It was necessary to construct a concrete arch over the aqueduct to carry the load of the fill. This arch carried a foundation loading of 6 tons per square foot.

On the north end of the job where there were other smaller cuts the excavation was handled entirely with 14-yard Carryall scrapers pulled by RD8's. The contractor handled the large slides mentioned above with another tool, namely a wagon drill. He put in a Cleveland wagon drill on top of the cut and drilled 30 to 50-foot holes and blew them with Trojan and Hercules dynamite to loosen the heavier rock slides and get them to the bottom of the cut in a hurry. It worked very well.

Spreading Oil-Mix Surface

The oil mix for the surface of the new section of this contract was mixed at the contractor's plant at Roscoe, Calif., a distance of 15 miles from the job. Reo and White trucks owned by the contractor, with six wheels and pneumatic tires and hauling a 10-ton load, were used for moving the oil-mix. These were dumped into the two spreader boxes equipped with heavy metal shoes 8 inches wide and 8 feet long which carried the heavy box and load over the surface easily and even made it possible to back the boxes short distances with no damage to the road and no tipping of the boxes. The boxes spread the material 9½ feet wide and 4 inches thick, loose. This was then bladed by two No. 11 Auto Patrols for a 2-inch surface. The mix used was made with a liquid asphalt having 90 to 95 per cent asphalt of an ROMC-4 grade. The maximum stone was ¾-inch for the top while for the binder about 200 pounds of rock over ¾-inch was allowed in a 2,000-pound batch. The 4-inch pavement was laid in two 2-inch courses and rolled with an 8-ton tandem.

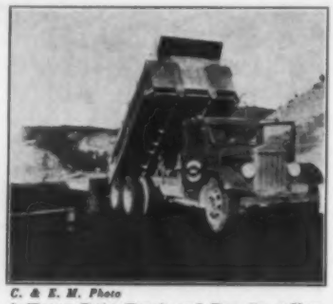
When planing the surface later the same day and sometimes the following day to remove bumps shown up under the straight-edge, a practice was followed that insures uniformity of cutting. Too frequently the grader man sets the blade just to hit the high spots and then he tears the surface and always leaves a rough place where the blade comes out of the bump and another where it enters. This is because the machine has to have all the slack taken out of it before it begins to operate to give a smooth cut, and therefore the state engineers have required a cut of 1 inch when taking out bumps. This gives a uniform pressure against the blade that takes all the slack out of the entire machine.

Major Quantities

The major quantities on this contract were as follows:

		Unit Price
Clearing and grubbing	197 sta.	$22.00
Water	9,500,000 gal.	.62
Removing old concrete, old tunnel and pavement	3,500 sq. yd.	3.00
Roadway excavation	520,000 cu. yd.	.334
Structure excavation	8,900 cu. yd.	.74
Ditch and channel excavation	6,200 cu. yd.	.54
Overhaul	530,000 mi.-yd.	.053
Asphalt, SC-2, prime coat	90 tons	6.00
Aggregate plant mix	17,600 tons	1.64
Asphalt for plant mix	930 tons	11.40
Asphalt, SC-2, shoulders	290 tons	4.00
Class A P.C. concrete pavement	6,400 cu. yd.	6.80
Bar reinforcing steel (pvt. and structures)	207,000 lb.	.05
Class A P.C. concrete structures	1,225 cu. yd.	17.00
Class A P.C. concrete curbs and gutters	780 cu. yd.	11.50
Class A P.C. concrete slope paving	850 cu. yd.	13.70

The roadway excavation was increased to 813, 224 cubic yards by the slides but the additional excavation was done at the lower figures quoted above.



C. & E. M. Photo

A Heavy-Duty Truck and Box Spreading a 10-Ton Load of Oil-Mix on the Griffith Job in California

Personnel

The contract for daylighting the old Newhall Tunnel and for the paving of 3.5 miles of highway with oil mix was awarded to Griffith Co. of Los Angeles, Calif., on its low bid of $348,496.75, which does not include the extra work on the slides. C. C. Bong was Superintendent for the contractor, and E. L. Seitz was Resident Engineer for the California Division of Highways, under S. V. Cortelyou, District Engineer.

New Front-Dump Shovel

A new patented shovel attachment, developed for use with Speeder or Link-Belt convertible machines, has just been announced by the Link-Belt Speeder Corp., 301 West Pershing Road, Chicago, Ill. Officially called the Johnson front-dumping shovel, it has been nicknamed the Speedersaurus because of its double-jointed rip-snatching action, according to the manufacturer.

This front-dumping shovel is designed for handling material that can not advantageously pass through the bucket, and for subgrading work where a skimmer might ordinarily be used. Using a powerful chain crowd with double leverage on the cutting edge, the action is somewhat like that of a trench hoe, but in reverse. As there is no hoist line running down to the top of the bucket, the unit can work in places where an ordinary shovel might foul.

The Johnson Front-Dumping Shovel

The manufacturer states that this new unit is particularly suited for land clearing; digging out trees, stumps and boulders; drainage ditch cleaning and building new ditches; ripping up and loading old concrete or macadam paving; and similar jobs. It is stated that in loading odd shapes of stone or torn-up pavement, the operator can balance a huge slab on the bucket and practically lay it in the truck.

Further information on the Johnson front-dumping shovel may be secured direct from the manufacturer or from this magazine.

NOW STANDARDE
LeTOURNEAUM

The U-20 LeTourneau Carryall depends upon ½" and ⅝" "Flex-Sof" Preformed Yellow Strand cables, with wire rope centers, for the economical operation of its famous "cable control."

A ½" "Flex-Sof" Preformed Yellow Strand cable, with wire rope center, handles the blade of the LeTourneau Angledozer.

The "cable control" of LeTourneau Bulldozers is ½" "Flex-Sof" Preformed Yellow Strand with wire rope center.

½" "Flex-Sof" Preformed Yellow Strand keeps the LeTourneau Rooter under perfect control.

The Improved Wheeled Roller

Improved Motorized Portable Road Roller

The improvements announced recently by Littleford Bros., 485 E. Pearl St., Cincinnati, Ohio, in its Model 150 motorized Wheeled Roller have been made to make it smoother in operation, easier to handle and simple to control. The principal changes are the new clutch and transmission having a larger gear reduction thereby producing more power, the driving mechanism and scrapers have been altered so that nothing extends out beyond the line of the roller. These changes make it possible to roll close to curbs or car tracks without interference by the driving sprocket.

This roller, which is designed for use on patch and restoration work by street and highway departments, contractors, and for parks and airports, takes care of patch rolling at very low cost because it can be attached to any maintenance truck and trailed at any speed to the job. The "tongue up-and-over" principle changes it from the trailing position to the rolling position in 60 seconds time.

Complete information regarding this Wheeled Roller may be obtained by those interested direct from the manufacturer.

New Vibrator Rig

A new combination vibrator rig mounted on a square swivel base with handles and wheel attachments that are removable has recently been announced by Concrete Equipment Manufacturers, 80 East Jackson Blvd., Chicago, Ill.

A New Combination Vibrator Rig Mounted on a Square Swivel Base with Removable Handles and Wheel Attachment

These attachments can be installed in five minutes, according to the manufacturer.

Marvel-Wyco vibrators are powered by Wisconsin air-cooled gasoline engines through a flexible shaft traveling in the Marvel-Wyco patented housing. A wide range of sizes is available, with electric as well as gasoline power. Literature describing these vibrators may be secured direct from the manufacturer by mentioning this item or from CONTRACTORS AND ENGINEERS MONTHLY.

EQUIPMENT ON ALL MACHINES

"FLEX-SET" PREFORMED YELLOW STRAND

After the most thorough tests and many careful field observations, R. G. LeTourneau, Inc., determined to supply "Flex-Set" Preformed Yellow Strand Wire Rope with every one of their famous "cable controlled" machines leaving the factory.

Thus the greatest economy in operation is assured right from the start: for "Flex-Set" Preformed Yellow Strand is made of "improved" plow steel of highest quality, drawn to our own exacting specifications—and 63 years' experience making nothing but wire rope has taught us what these specifications should be.

Preforming makes the rope limp and tractable—easy to handle and install—highly resistant to kinking—amazingly durable.

Maintain the economical operation of your LeTourneau equipment by replacing worn cables with "Flex-Set" Preformed Yellow Strand.

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The Federal-County Relationship Problem

(*Continued from page 4*)

which will complete the administrative group needed to execute the national highway program.

This can not be done in a day, or a year, or possibly not in five years. But it can be started. And once under way, the beneficial effect of a coordinated harmonious effort will guarantee its satisfactory attainment. If it were possible to brush aside the accumulated rubbish of selfish interest and the barriers of administrative intolerance and indifference, the triangle could be quickly joined together, and all of the agencies would benefit at once through a united attack on faulty financing, loose administration, and wasteful execution.

Practical experience leads us to believe that this will not be the case, however, and it must be the concern of some agency to revive flagging interest, smooth the rough going, and conciliate different points of view arising from the many problems involved in the tripartite plan. It is to our share of this task that the County Highway Officials' Division of the American Road Builders' Association dedicates its major efforts.

As contributing factors to the attainment of this public service ideal, there are, in our estimation, three main objectives:

1. Continuation and increased allotments of Federal Aid for highways. This means not an increase of Federal road-user taxes but the full utilization of taxes now being collected and which are being diverted by the Federal government.

2. Recapture of road-user taxes now being diverted by the states to general and specific purposes other than highway construction and maintenance. On the theory that the loss and depreciation, as a result of diversion, of the capital expenditure already made in highways is more than the diverted funds, it should be the duty of highway administrators to join outside agencies in the discovery and provision of funds to replace those the highway industry seeks to recapture for the highways.

3. Rearrangement of county government to enable it to provide the efficient prosecution of its share of the highway program, in the same ratio of efficiency as its associated agencies.

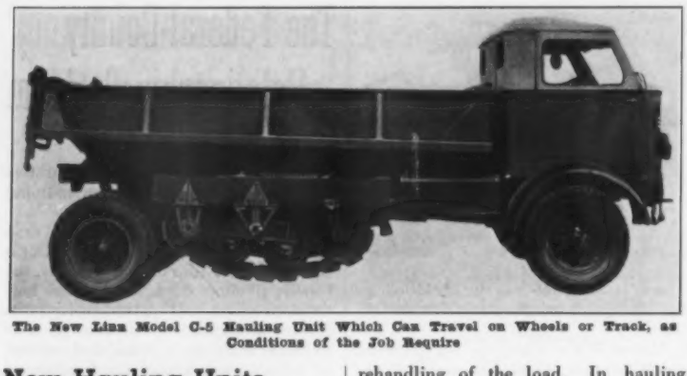
This will probably require in each state the creation of a factual state-county relationship which must be founded on a fair and equitable basis of mutual respect for the welfare of each agency, and a determination to work in sympathetic cooperation for the good of both administrations, and in consequence for the public good.

County government, fighting for the survival of the important ideal of local self-government, is organizing in a manner that may well present a formidable concentration of influence. This influence must not be allowed to become a blundering agency, bent on vengeful reprisals for real or imagined grievances of the past. It can and must be guided within the channels of orderly and intelligent service to its local citizens, to the state and to the nation.

New-Principle Crushers

The Kue-Ken principle of crushing, claimed to be an entirely new method of approaching the problem of rock crushing, is described and illustrated in Bulletin 600 issued by the Straub Mfg. Co., 532 Chestnut St., Oakland, Calif. This catalog also contains a complete description and photographs of the Kue-Ken crushers made by this company.

Copies of Bulletin 600 may be secured direct from the manufacturer by mentioning this item.



The New Linn Model C-5 Hauling Unit Which Can Travel on Wheels or Track, as Conditions of the Job Require

New Hauling Units Use Wheels or Track

A new type of hauling unit which can be converted instantly from track to wheel operation or vice versa, merely by throwing a control lever mounted at the driver's position, has recently been announced by the Linn Mfg. Corp., Morris, N.Y. Developed to provide a unit of greater flexibility and broader utility, the Model C-5 is claimed by the manufacturer to be particularly suited to road construction and maintenance, all hauling problems of townships, counties and states, including snow plowing, and to similar haulage needs of contractors.

The illustration shows the C-5 operating on dual pneumatic-tired wheels, with 7 inches of road clearance under the traction unit. In this position, the drive is on the front wheels, the traction unit idling and merely revolving if it hits an obstruction. The load distribution is divided evenly on the front and rear wheels, and the unit has a maximum speed of 35 mph. When track operation is desired, the operator pushes the control lever and the rear wheels are raised hydraulically to allow 9 inches of road clearance or they can be allowed to trail or float behind the Linn traction unit which is designed to provide traction over uneven surfaces. When the C-5 is operating on tracks, the load distribution is 75 per cent on the tracks and 25 per cent on the front wheels, with the drive on the tracks and front wheels simultaneously. The maximum speed, with a full load, is 12 mph.

With either track or wheel operation available at the will of the driver, it is claimed that the Model C-5 will handle many types of hauling jobs which at present require auxiliary equipment or rehandling of the load. In hauling from pits, for example, the C-5 comes up out of the pit with its load on its tracks and when it reaches a good road, it can change over to wheel operation and roll away at regular truck speed. In addition, it will handle jobs requiring steady track operation, or others requiring wheel operation. If hauling is to be over good roads for any protracted period, the entire traction unit can be readily removed. The hydraulic jackknife lever unit which raises and lowers the rear wheels locks off center so that when operating on wheels the load is carried on the rear axle only.

The body capacity of the C-5 is 5 tons and the chassis weight, with cab, approximately 11,500 pounds. The engine is a 6-cylinder Hercules, built to special Linn specifications, rated at 105 bhp at 2,400 rpm, either gasoline or diesel. The engine is mounted on a track, underneath the cab, and can be readily removed from the front end. All shafts are tubular and are used for oil or lubricant reservoirs to minimize lubrication needs. The track suspension spring arrangement is designed so that the entire assembly is placed inside the frame outrigger, just over the tracks themselves. Standard equipment includes four-wheel hydraulic brakes, parking brake, electric lights and starter, tail and stop light, shock absorbers, windshield wiper, two tow eyes in front and rear drawhead, and tool kit.

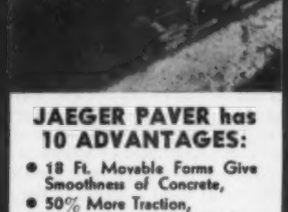
Further details on the new Linn Model C-5 hauling unit may be secured direct from the manufacturer by mentioning this item, or from this magazine.

Former Continental Men Join Gar Wood Industries

Coincidental with the recent acquisition of the Tractor Equipment Division of the Continental Roll & Steel Foundry Co., East Chicago, Ind., by the Road Machinery Division of Gar Wood Industries, Inc., Detroit, Mich., announcement has been made of the appointment of a number of former Continental personnel to the Gar Wood staff.

W. J. Adams, who worked the first Continental scraper in the field and was the original designer and patentee of the two-wheel Continental scraper, has joined the engineering staff of the Road Machinery Division of Gar Wood. Duke Kerrick and Gil Koehler have been made field representatives and J. E. White has been appointed a sales engineer.

LAYING BLACK TOP?



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- Blends Perfect Joints,
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FOR THE AMAZINGLY VERSATILE

A-W "99"

REAR ROLLER . . . Provides a range of compression up to 215 lbs. per lineal inch. Is built in three removable sections; measures 6 ft. long x 30 inches in diameter; operates hydraulically.

DISC HARROW . . . Cutting width about 6 feet. Uses 20 inch heat-treated steel discs. Operates hydraulically. Discs can be angled to suit work. Extremely rugged. A real time saver on difficult discing jobs.

POWER DRIVEN ROTARY BROOM . . . Steel wire. Measures 8 feet long x 26 inches in diameter. Broom pressure on pavements, direction of sweeping, etc., controlled hydraulically from cab.

SCARIFIER . . . Available with staggered tines or tines arranged in V-formation. Hydraulically controlled. When scarifier is raised, hinged block causes tines to fold up, affording extra clearance.

• A "99" Motor Grader never has to be supported in idleness for long periods. It does everything you could possibly ask of a super-powered motor grader; and, in addition, it can be used as a scarifier, roller, broom, harrow, bulldozer, backsloper, snowplow and for pulling other types of equipment.

These PLUS uses . . . eliminating the necessity of investing in a battery of costly auxiliary outfits . . . are made possible by the "99's" extra power, maneuverability, and simplicity of operation. Driving on all four wheels, a "99" can always apply power exactly where you need it for a wide variety of jobs. Front and rear steer enables the operator to put his wheels where he can get the best traction . . . an operating advantage no other motor grader can supply.

No wonder so many "99" owners say this versatile machine would be a "smart" buy at much more than its actual cost. The Austin-Western Road Machinery Co., Aurora, Illinois.

AUSTIN-WESTERN

Motor Graders
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Washing Plants
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3-Yard Tractor-Scraper
6-Yard Tractor-Scraper
8-Yard Tractor-Scraper
12-Yard Hydraulic Scraper

Gravel Bases For Black-Top Surfaces

Details on Methods for Rebuilding Old Bases and Placing Gravel Wearing Surfaces in Michigan

By OTTO S. HESS, Engineer-Manager, Kent County, Mich., Road Commission

✦ THE construction of low-cost black-top surfaces in Michigan has increased progressively over the past 10 to 12-year period until today this type of construction makes up a very large percentage of all highway construction in the state, particularly on those roads under the jurisdiction of the county road commissions. Nearly all of the first black-top surfaces were placed on the old gravel roads with little or no preparation of the base. These surfaces proved to be satisfactory only in those cases where soil conditions were sufficiently good to offset the weakness of the gravel surfaces. Where these surfaces were placed over clay or other unstable subsoils, many failures were experienced; these failures led to the development of various methods for overcoming weaknesses in the base.

Old Roads Make Poor Bases

At first the base work was confined entirely to those spots which were known to break up practically every spring when the frost went out of the ground, but it was soon learned that this procedure did not always take care of the situation. In many cases the subsoil did not behave the same after it was covered by water-tight surfaces which prevented the evaporation of moisture contained in the gravel or subsoil.

Surveys to determine the quantity of gravel on these old roads have also produced some surprising information. Instead of having 6 to 8 inches of gravel as originally constructed, they frequently had only 2 to 3 inches, with occasional spots having none at all. These surveys showed that the black tops were depending largely on the subsoil rather than on a properly constructed gravel base for support.

Another factor was concerned with the width of the old gravel surfaces. Most black-top surfaces now being constructed are 20 feet wide whereas practically none of the old gravel surfaces were built more than 16 feet wide. Unless these edges were trenched out and filled with gravel, many edge failures developed on the black tops.

Black-top experience in Kent County covers a period of about 8 years, during which time 125 miles of black-top surface on gravel base has been built. We have undergone most of the unpleasant experiences which have been encountered generally, and have developed certain methods for overcoming the difficulties. This article describes the methods which have been successful in our particular territory, but is not intended to suggest that these are the only satisfactory methods or that they will meet all conditions in other localities.

Preliminary Work Essential

In correcting base troubles we have found that the work usually involves so much of the road that our present practice covers base preparation on the whole length of the road in practically all cases. First a complete survey and plans for each road are made in the same manner as for new construction. Because of the drainage work necessary, the job usually involves the widening and reconstruction of the grade as well as the surface and it is therefore advisable to compute earth work quantities in order that the work may be most economically planned before it is started. There is probably too great a tendency on the part of highway officials to minimize the engineering work on this type of project but it should be kept in mind that the proper planning of road reconstruction before starting the work is just as important as proper planning for original construction. A survey should include complete information regarding the width and depth of gravel on the road, and also borings to determine the soil characteristics and the location of water in the base, either as free water cropping out at various points along the surface and as capillary water found under certain subsoil conditions.

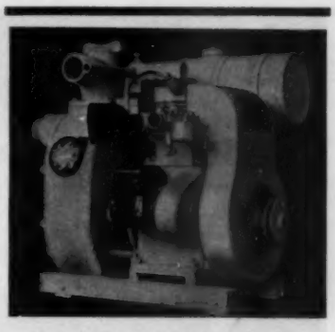
Subsoil Conditions

Inasmuch as the black top is only a wearing course and has practically no slab strength, all weak spots in the base must be corrected if surface failures are to be avoided. Where the soil is made up of sand, gravel, sand-clay, or other porous materials, it is necessary only to see that the road has proper drainage and a gravel surface of reasonable width and thickness properly compacted. Where subsoil conditions are unsatisfactory, special treatment must be applied to fit the various types of conditions encountered.

In some cases it is necessary only to provide proper drainage; in a large number of cases, however, it is necessary to overcome capillary soil conditions or instances where the water is too close to the surface. In trying to correct these unstable subgrade conditions, it must be remembered that we are building a low-cost road and that it is impractical to apply the refinements carried out on high-type construction. For this reason it is usually unnecessary to excavate all unstable subsoils and replace them with stable material.

In all cases encountered in Kent County, we have found that by raising the grade with a foot or more of sand, sandy gravel, or other porous material and then constructing the gravel surface on this as a base, we have successfully over-

(Continued on page 30)



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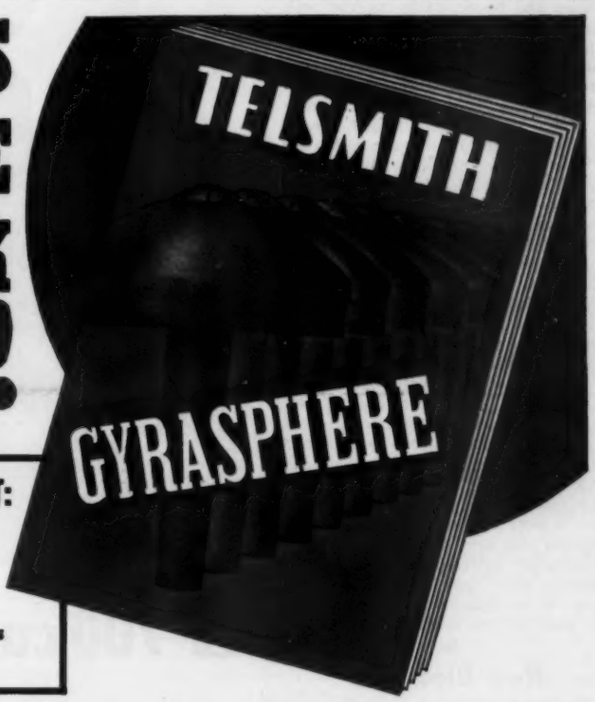

IT TELLS YOU HOW TO GET:

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- lower power and upkeep costs

● THIS BOOK is written for the man who wants *the real dope* on secondary crushing—the man who has to have the cold facts before he lays down the cold cash.

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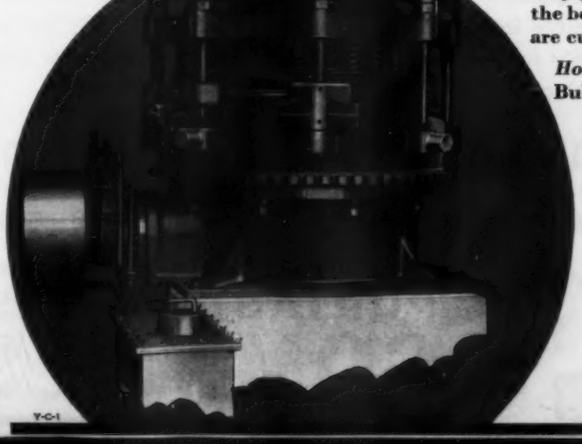
How spring relief protects against clogging by fines and breakage by tramp iron. *Why* roller thrust bearings prevent misalignment.

How oil leakage is effectively prevented. *Why* grit and water positively cannot get into the bearings. *How* oil and maintenance costs are cut as they were never cut before.

How can you get this book? By asking us for Bulletin Y-34. *Why not* send for it now?



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The New Universal Duplex Crushing Plant Equipped with a Rotavator

New Type Elevator For Crushing Plant

In the new dual crushing plant recently announced by the Universal Crusher Co., Cedar Rapids, Iowa, the belt conveyor return system for feeding back material from both the primary jaw crusher and the secondary crushing rolls has been replaced by the new turbine-type revolving elevator called the Rotavator which conveys material discharged into it by the under crusher return conveyor to the screen feed conveyor directly above. The savings in weight, overall length and width resulting from the use of the Rotavator provide a lighter more portable unit, while the cycle is actually shortened, speeding up production, according to the manufacturer.

The Rotavator is made under the Morrissey patents and patents pending which have been assigned to the Universal Crusher Co. and merged with its patent claims. Features of the Morrissey wheel have also been incorporated in the design of the Rotavator.

Other equipment of the new Universal Duplex crushing plants includes a 2½-deck 3-foot x 8-inch screen, hopper and grizzly, feeder, sand ejector, streamlined 10 x 36-inch light-weight crusher, and 30 x 18-inch rolls. The plant is of welded construction, has twelve low-pressure tires to meet state road regulations, and requires only one operator.

Complete information on this new crushing plant may be secured direct from the manufacturer by mentioning this item, or from this magazine.

New Electrode

The Hardweld 50, a new medium carbon-steel electrode recently announced by the Lincoln Electric Co., Cleveland, Ohio, is designed for the building up of steel parts and surfaces. The deposit has considerable resistance to deformation and wear and is machineable at slow speed, according to the manufacturer.

The dipped coating stabilizes the arc and permits the deposition of a tough dense medium carbon steel. When deposited on straight carbon steel and allowed to cool naturally, the hardness of the deposit will be approximately 20-35 Rockwell C. The deposit may be hardened by the usual water quench from the above approximately 1,500 degrees F. or by flame hardening methods. Hardweld 50 can be used for vertical welding, but for best results the work should be fairly horizontal.

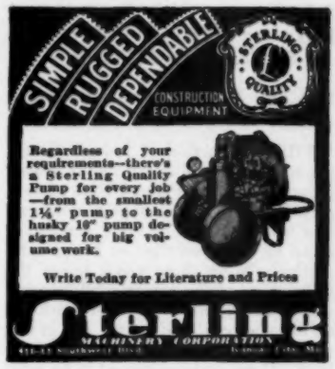
Two rod sizes are available, 3/16-inch for a current range of 150 to 225, and ¼-inch for a current range of 200 to 350.

Equipment Cleaner Boon to Contractor

F. H. Weiss, Le Center, Minn., is one of the increasing number of contractors who overhaul and repaint their equipment during the winter months. Last year Mr. Weiss gave all his equipment, including five Caterpillar tractors, three LeTourneau scrapers, an elevating grader, two blade graders and trucks, a thorough overhauling.

Early in the autumn Mr. Weiss purchased a Model KG Hypressure Jenny which was used for cleaning all the equipment before repainting. In addition, after the equipment was taken down, all parts were thoroughly cleaned by the steam. This method of equipment cleaning proved so satisfactory that Mr. Weiss states that he would not care to overhaul his equipment again without the aid of Hypressure Jenny.

Dull orange-colored roadways, said to have 40 per cent less glare, are claimed to be reducing traffic accidents in the Channel Islands.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With an actual capacity of 700 cubic feet per minute (at 100-125 lbs. pressure) this highly efficient Diesel-driven CP Portable will do the work of a number of smaller units — with a saving in fuel, attendance costs, maintenance expense. » » » Employed instead of a stationary installation, it eliminates the necessity for foundations, setting up, pipe lines, electric and water connections, housing, etc. » » » Operates at full capacity with an economy unequalled by any other portable compressor. Conservatively rated, this CP 700 cubic foot unit is suitable for twenty-four hour service. » » » Write for Bulletin 762 giving complete details and specifications.

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Reflector Marker for Roads

Complete information on the Saf-T-Eye road marker for marking traffic lines, outlining pavement edges and indicating other hazardous spots along the highway is contained in literature of the Saf-T-Eye Co., Inc. The manufacturer states that this marker was developed after three years of research and has been tested under heavy duty both in its own yard and on streets and highways.

Interested state and county highway engineers may secure further information on the Saf-T-Eye road markers from the Saf-T-Eye Co., Inc., c/o Phoenix Glass Co., Monaca, Penna., by mentioning this item.

Working in the Dry

This is the title of a new 92-page booklet on the Moretrench wellpoint system for dewatering any type of wet soil. In addition to detailed descriptions of Moretrench wellpoints and wellpoint pumps, and information and diagrams on various types of installations, this booklet also contains a large number of job photographs, showing the variety of construction jobs on which Moretrench wellpoint systems have provided dry working conditions.

Copies of this booklet may be secured by interested contractors and engineers direct from the Moretrench Corp., 90 West St., New York City, or from this magazine.

Free Guide for Truck Driver

A truck driver's guide which enables him to keep operating costs down and to drive with maximum safety is offered without charge by the Dodge Truck Division of the Chrysler Corp. Written in simple yet forceful language, this guide covers a wide variety of subjects, including the care and treatment of truck engines, how to make tires last longer, the importance of the proper treatment of clutch, brakes and transmission, safety and courtesy on the highway, and numerous other topics important to truck driving.

Copies of this booklet entitled "Ways to Cut Costs and Play Safe—A Guide for Truck Drivers" may be secured without charge or obligation by interested readers of CONTRACTORS AND ENGINEERS MONTHLY direct from the Dodge Truck Division, Chrysler Corp., Detroit, Mich., by mentioning this item.

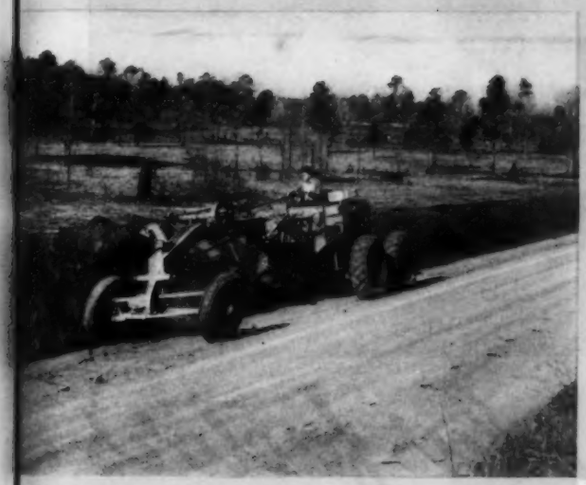
Pile it on!

"CATERPILLAR" DIESELS CAN HANDLE ALL YOUR JOBS!

"Caterpillar" Diesel D6 Tractor equipped with a bulldozer and a Hyster winch. It's working 8 hours a day on 1½ gallons of 8½-cent fuel an hour. Let's look at its jobs.

First of all, the winch. This piece of equipment almost doubles the tractor's drawbar-pull. You see it, here, clearing out trees—dragging them in across narrow, steep gullies where no tractor could possibly go. This is only one winch-use. You can put it to boosting heavy loads over steep grades . . . operating a drag-line . . . pulling stumps.

The 'dozer, of course, extends this tractor's usefulness even further. And the drawbar is free for all the normal work of a tractor.



The new "Caterpillar" No. 112 Motor Grader—companion model to the "Caterpillar" Diesel No. 12 Motor Grader—which is the strongest, fastest operating, most versatile motor grader available!

The blade-positions on this new machine are practically unlimited. You get ample clearance at the front and rear. The blade is fully revolving. You can work in reverse on subgrades and in narrow quarters without turning the machine around. Also, the blade can be set at a 90-degree vertical angle . . . trailed for finishing slopes . . . and extended 6 feet, 5 inches beyond the line of the wheels.

As for jobs, the No. 112 Motor Grader makes ditch cuts, high-bank cuts, flat-bottom ditch cuts, low-bank cuts. It scarifies, blades, handles oil-mix, removes snow, teams-up with a roller.

Here's one of the handiest outfits you'll ever see! It's a "Caterpillar" Diesel D4 Tractor with a Tracklson high shovel. This particular rig, loading gravel into a truck, works 8 hours a day on only 1½ gallons of 9-cent fuel an hour!

Other road-jobs for this "Caterpillar" Diesel include excavating . . . ditching and culvert laying . . . pulling discs and rollers . . . loading out rock and compacted material . . . pulling fence posts . . . cleaning out ditches and building up shoulders. And, of course, the drawbar is available for countless pulling-jobs. In addition, a bulldozer can be attached in a matter of minutes.

It seems as though a "Caterpillar" Diesel no sooner gets one job done than it's put right on *another!* That's because any type of this equipment—engine, tractor, or road machine—is able to do many tasks, *and do them all well!*

As a result, you can cut down your building-and-maintenance fleet . . . accomplish as much work, and probably more, with "Caterpillar" Diesels. And as far as operating-costs go, you're practically sure of *cutting* those too. For these machines take only a minimum of inexpensive fuel—and keep unusually free from replacements and repairs!

Look over the pictures here. Notice the work that's being done—and all the other work it's possible to do. You can pile all kinds of jobs, and plenty of them, on a 'Caterpillar" Diesel! Get in touch with your nearest "Caterpillar" dealer, or write direct for more information. CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS.

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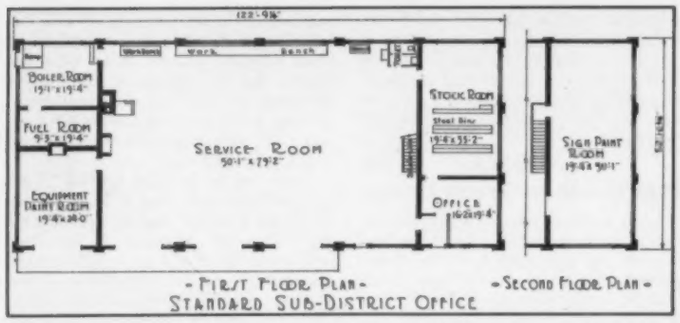


STANDARD SUB-DISTRICT OFFICE

Well-Designed Service Rooms Aid Road Work

(*Continued from page 5*)

All of the equipment is repaired in the service room, with the exception of a complete motor overhaul which includes the reboring of cylinder walls and the relining of the crankshaft. This work is done in the Central Garage in Indianapolis. Equipment is brought periodically to the service room for complete lubrication by the automatic pressure grease gun.

The sign room is for the storage, repair and refinishing of road markers and signs. The equipment consists of a paint spray gun, enclosed racks for signs, easels for refinishing signs, and tables for stencil work. Signs in good condition, except for paint, are refinished here. A complete stock of reflector buttons, for use as replacements in signs, is kept on hand. Shelves, enclosed by doors, provide an orderly means of stocking signs, tools and paints.

The stenciling of signs which have raised numerals, letters, directional arrows, and borders is done with a printer's roller. This not only eliminates hand stenciling but also enables the workmen to get a clear-cut and regular edge for the raised portions of the sign, and the stencil paint is applied more evenly.

Painting the Equipment

Equipment will be kept well painted if a modern and safe paint room is provided. We have found well-painted equipment essential to instill pride in its operator, to increase the life of the equipment by making it resistant to rust, and to show the motoring public that the state highway department is doing its job well and spending wisely the public money entrusted to it.

In the equipment paint room pressure spray guns are used for painting equipment. When the paint is being sprayed, the fumes are carried out of the room by means of an 18-inch diameter fan mounted on the top of a vent flue.

The following equipment, available for the maintenance of the highways within a subdistrict, is cared for at the subdistrict headquarters: 2-ton patrol trucks, a heavy motor grader, 8-foot blade graders, multiple-blade maintainers, a ⅜-cubic yard shovel, portable bituminous mixers, portable rollers, gas rollers, a center-line marker, traffic-lane markers, 165 and 300-gallon tar kettles with motor-driven sprays, one-way and V-type snow plows, crawler and wheel tractors, mowers, power sweepers, an 800-gallon bituminous distributor, a portable 2-car tank-car heater, a 10-ton pneumatic-tired trailer, concrete mixers, a Mud-Jack, a portable air compressor, and sand spreaders for ice control.

Storage Sheds

There are two storage sheds, approximately 33 feet x 81 feet in size, with concrete foundations and approach aprons, at each subdistrict headquarters. One shed has four bays, two of which are paved with concrete and enclosed with wood partitions, and the other two paved with crushed aggregate. In one concrete-paved bay, picks, shovels, lanterns, and maintainer blades are stored and in the other, cement and calcium chloride. The remainder of the shed is used for equipment storage. The second shed is paved with aggregate and used entirely for the storage of equipment.

Gasoline and oil are kept in a fireproof brick fuel house, located near the headquarters building, and equipped with a modern gasoline pump and oil storage tanks. One or more tanks, located at the back of the lot for the storage of bituminous materials, are equipped with coils so that the material may be heated, if necessary.

Work of the Highway Patrol

The patrol is the nucleus of the highway-maintenance organization. The personnel includes a patrolman who is in charge, one or more equipment operators, and one or more laborers. Each patrol is approximately 20 miles in length, according to the type of road surface. The length of a drag-surface patrol is shorter than one on paved roads because of the additional work necessary to keep the surface in good condition.

The equipment of a drag-surface patrol usually consists of a 2-ton truck, an 8-foot blade grader, a snow plow, wheel tractor, multiple-blade maintainer, mower, and small tools as required. Gasoline and oil for the patrol equipment are dispensed at the patrol headquarters. Minor mechanical repairs are made on the road but major repairs are made in the subdistrict headquarters.

Regular maintenance work on a drag

(*Concluded on next page*)

CONCRETE VIBRATORS
(Gas and Electric)
Concrete Surfacing Attachments

Master Vibrator Company, Dayton, Ohio
DISTRIBUTORS IN ALL PRINCIPAL CITIES

Check these plus factors

of Bethlehem Road Joints

They reach the job with dowel-caps attached

BETHLEHEM Road Joints reach your job as a unit. Dowels are shop-welded and braced in perfect alignment. Slip dowel-caps are pre-attached. There is no need for bothersome assembly on the job. All that's necessary is to add the steel-capped joint filler and set the joint in the road.

They anchor solidly with less driving

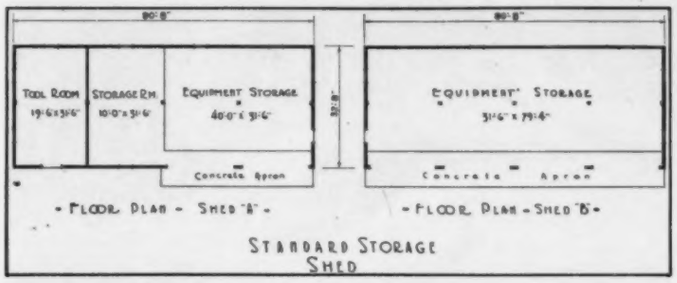
Bethlehem Road Joints are anchored to the sub-grade by pins driven through the dowels. The dowels themselves carry much of the pressure of concrete, which was formerly carried by the earth alone. Result: A 10 in. x ⅜ in. pin used in a Bethlehem Joint has the same holding power as a 15 in. x ½ in. pin used in other constructions.

They won't tip over when concrete is poured

Bethlehem Road Joints have an equally strong support on both sides of the filler mat. They won't tip out of line when concrete is poured or when the finishing machine passes over the joint. They require less attention during concreting, function more smoothly in the finished road.

BETHLEHEM STEEL COMPANY

BETHLEHEM STEEL



STANDARD STORAGE SHED

Regular Maintenance On Indiana Highways

(Continued from preceding page)

patrol consists of dragging the surface to keep it smooth, adding aggregate when required, smoothing shoulders or berms, cleaning ditches, cleaning structures, and mowing and cleaning the right-of-way. Additional dragging of the road surface is done after each rain because then it is easy to cut the high points and fill in the depressions. Aggregate should be spread on the surface only when needed and in such amounts that a thin mulch will result when the surface is maintained. The public should never be required to travel over an excess of loose material, because it is dangerous and unnecessary. All our drag surfaces are made dustless by means of a dust palliative and as soon as the surface is sufficiently stable a road-oil mat is constructed.

A paved-surface patrol is one with bituminous or cement concrete surface. Concrete surfaces are maintained by pouring cracks, patching the surface, and repairing blow-ups. Bituminous surfaces are repaired by patching with materials similar to those used in the original construction. It is imperative that the bituminous mixture be of the same composition as that used originally, as a patch made of a softer mixture will cause a depression and one made of a harder mixture will cause a hump because their stability is different from that of the surrounding surface. Other operations on a paved-surface patrol are the same as those on a drag-surface patrol.

A truck shovel is used at all points in the subdistrict to remove small slides and other excavation which is not a part of the regular patrol duty. The uses for this piece of equipment are many, and it is very economical in operation.

Safety Measures

For center-line marking, the marker shown on page 5 stripes approximately 25 miles of highway a day and is equipped for the application of bituminous material or paint. Liquid asphalt RC-3 is used for the center line on all concrete and gray surfaces. For a black surface, the RC-3 stripe is applied and immediately covered with clean stone chips, all of which pass a 3/8-inch square screen. This line is white and embeds itself into the road surface. Such lines have been in place on many road surfaces for a period of six years.

Another safety measure is the placing of single crystal reflector buttons, 7/8-inch in diameter, in certain guide and guard-rail posts at hazardous places along the highway. A vertical unit of three reflector buttons is attached to the end of the hand rails of all bridges having a clear width of 24 feet or less and all warning signs are reflectorized.

It is recommended that reflector buttons be used only at hazardous locations, because their over-use causes them to be disregarded by the motorists and eventually defeats their purpose.

Want information? Write the Editor.

Hand Pump for Testing Diesel Fuel Injectors

A compact, portable hand pump for testing diesel fuel injectors in the field is now being made by the Diesel Equipment Corp., 4401 N. Ravenswood Ave., Chicago, Ill. This pump is designed to permit the user to check all size injectors of all standard makes, including Deco, Timken, Bendix, Bosch, Caterpillar, Hesselman, International and others. The manufacturer states that it is so simple to use that testing fuel-injection systems can be made a part of a routine service job like greasing and oiling.

The compactness of the Deco hand pump makes it especially handy for use in the field. It is only 9 inches high, weighs 6 pounds, or with the detachable handle, 8 pounds. Any mechanic can easily measure injector opening pressure and determine the correct adjustment, determine whether the spray pattern is uniform, and detect any other irregularities such as stuck needle valves or leakage. With this hand pump, opening pressure can be tested without removing the injectors from the engine block, thus obviating the danger of damaging the tips during removal. Only when the test indicates that adjustment is needed is it necessary to remove the injectors.

The Deco Hand Pump for Testing Fuel Injectors

Complete information on the Deco hand pump may be secured by interested contractors and state and county highway engineers direct from the manufacturer by mentioning CONTRACTORS AND ENGINEERS MONTHLY.

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DRY WET JOBS AT A PROFIT!
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OVER 500 ARE SPREADING THE Buckeye Way
- laying it down "LIKE UNROLLING A RUG!"

This machine cannot be judged by the performance of any other spreader you have seen or used . . . materials ranging in size from sand to 1 inch stone are laid down in any volume from a mere sprinkle to 65 pounds per square yard with practically no variation mile after mile. It is equally accurate in operation moving either forward or in "back-up" spreading.

The coupling device is swiveled and also adjustable vertically . . . adjustments can be made while hitched to the truck with the spreader box loaded or empty, by a convenient crank control at the end of the box. You make or break the hitch easily even when the spreader or truck is on uneven ground.

Wet sand or similar materials are kept moving by a reversible spiral agitator. This agitator is quickly disengaged or removed when not needed.

No other spreader has all the features of the Buckeye . . . write today for complete data and prices.

BID THE Buckeye WAY
ask for our operation data before you bid

Buckeye Surface Material SPREADER
OVER 500 IN USE
PATENTED AND MANUFACTURED BY
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Big Diesel Dredge Converted to Steam

McWilliams Dredging Co. Changes G. A. McWilliams To High Pressure Steam Plant for Hydraulic Work

✦ THE continuous progress of diesel power for practically all construction equipment was checked momentarily when the big diesel dredge G. A. McWilliams of the McWilliams Dredging Co. of New Orleans, La., described in some detail in the March, 1938, issue of CONTRACTORS AND ENGINEERS MONTHLY, page 32, was converted to steam power late in 1938 at Plaquemine, La. The change demonstrates the great strides that have been made by high pressure steam as a competitor of other economical power.

The original steel hull, 140 feet long x 36 feet wide and 9 feet deep with a normal draft of 7 feet under working conditions, was widened to 45 feet and the length increased to 168 feet, while the draft is now about 7.5 feet. The rebuilt dredge is 279.5 feet long from the end of the ladder to the spuds while the maximum digging length is 249 feet. The old 70-foot ladder has been replaced by a new one of 102 feet, giving a maximum digging depth of 75 feet.

The New Steam Plant

The single Babcock & Wilcox water tube boiler equipped with five B & W oil burners using Bunker C fuel oil maintains 460 pounds per square inch pressure for the turbines. For full 24-hour operation the dredge uses about 190 barrels of the fuel oil. Boiler feed water is taken from the river and treated with alum, make-up water being required about once a week. A complete chemical laboratory for the testing of the treated water is maintained on the dredge and is checked regularly by a commercial laboratory. The oil burners are automatically controlled both as to the oil supplied and the pressure, according to the demand for steam by the equipment on board. The steam-driven equipment includes two DeLaval steam turbines, the 3,500-hp main turbine and a 1,300-hp unit for the main generator, and a steam fire pump.

Fuel oil is delivered to the dredge by two 5,000-barrel barges measuring 200 x 40 feet by 8-foot draft. The barges are equipped with pumps so that all the dredge has to supply is the steam for the refueling operation. The bunkers in the dredge have a capacity of 1,500 barrels.

Steam-Driven Electrical Equipment

None of the heavy electrical equipment has fuses to be replaced in case of overload. Automatic breakers are used for overload and require only resetting, with a minimum of lost time for placing the machinery back in operation.

The main generator is a Crocker-Wheeler Co. 250-volt 2,400-ampere 600-kw unit at continuous operation at 40 degrees C, driven at 900 rpm through a 6.7 to 1 helical gear from the DeLaval 1,300-hp steam turbine rotating at 6,030 rpm. The turbine has sixteen stages, and operates with a 28-inch vacuum from the steam at a boiler pressure of 450 pounds and 290 degrees of superheat.

The main turbine has seventeen stages and delivers 3,500 hp at 3,100 rpm under the same steam conditions as the other turbine. The governor on the turbine trips at 3,880 rpm. The normal operating speed for the work of the dredge is 2,550 rpm which is indicated by a Reliance tachometer which shows both turbine and pump speeds. The gear reduction between the turbine and the pump is through a DeLaval 9.2 to 1 helical gear. An auxiliary reduction on the same line driven by an electric motor permits the unscrewing of the pump impeller by machinery instead of by the usual hand methods when removing the impeller from the shaft pump shell. The impeller now being used is a 3-vane unit 82½ inches in diameter built by the contractor from their own designs. The distance between the shrouds of the impel-

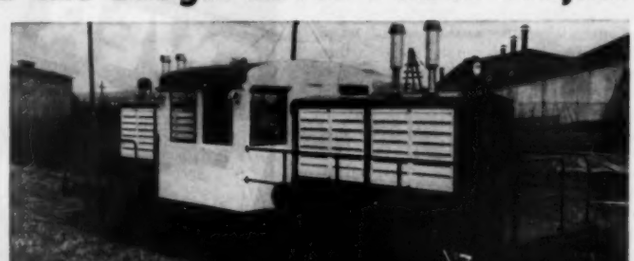
(*Concluded on page 32*)

C. & E. M. Photo

Discharge from the Land Line of the Dredge G. A. McWilliams During Work on the Glasscock Cut-Off

Hauling Cement for the Skagit River Power Project

On their Skagit River Power Project, which will ultimately deliver 1,120,000 hp., the City of Seattle Lighting Dep't uses this locomotive to haul cement from Rockport to Newhalem, Wash., about 23 mi. Average grade is .3% for the entire distance with maximum uncompensated curves equivalent to 1.6% for short distances. Gross loads on regular hauls are in excess of 560 tons and 46-mi. round trip is made in three hours. Average fuel economy per round trip, 245 ton-miles per gallon of diesel oil.



POWER PLANT:

- Two WAKH 160 to 200 hp. 6¼ x 6½ six-cylinder Waukesha Multi-Fuel Spark Diesel Engines governed at 1600 rpm.
- Two Generators, Westinghouse, 180-L-5, 600-volt.
- Four Motors, 85 hp., continuous rating, 25% overload capacity for 1 hr.
- Reduction, 4.33 to 1.
- Over 200 indicated electrical hp. at each generator coupling, for periods in excess of thirty minutes.

World's Most Flexible Engine

One of an entirely new line of Waukesha Industrial Engines—this Model WAKH can burn diesel oil, gasoline, butane, propane and other gaseous fuels *by simply changing the fuel system accessories.* All the engines in this new Multi-Fuel, Poly-Cycle series are likewise convertible—practically universal engines—change of fuel involves no modification of internal parts.

● From the operator's standpoint this new industrial engine has the greatest possible flexibility—with the greatest over-all economy.

As an oil engine it burns a wide range of easily obtainable domestic furnace oils as well as high-speed diesel fuels. Operating on the Hesselman low-pressure cycle, utilizing positively-timed spark ignition, it gives you the advantages of—light weight . . . easy starting . . . long life . . . and low maintenance.

Moving to different locations you can change to gasoline, butane or propane fuel—*without touching a single internal part!* Simply replace the fuel injection system with a gasoline or butane carburetor. Change-over expense and capital investment are held to a minimum. *Write for literature.*

WAUKESHA Multi-Fuel Poly-Cycle ENGINE

WAUKESHA MOTOR COMPANY
WAUKESHA, WISCONSIN
NEW YORK • TULSA • LOS ANGELES

WON'T QUIT
or cause time out

A Hayward Bucket keeps the job going ahead on scheduled time. It won't quit or cause time out.

●

The Hayward Company
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Hayward Buckets

Details of Construction of the New Airflex Rubber Clutch

New Use of Rubber For Engine Clutch

An entirely new use for rubber has just been announced by the General Tire & Rubber Co., Akron, Ohio, whose engineers have recently developed a new type of rubber clutch to perform all the work hitherto done by plate-type clutches on engines. This discovery grew out of the study of the ability of General's dual 10 and 8 squeegee-tread tires to stop a motor car quickly on wet, slippery pavements.

It was found that, under braking pressure, the many narrow vanes or ribs of rubber squirmed into a serpentine form and clung to the road surface. Adhesion being the principal job of a clutch, it was only a step to the development of the Airflex rubber clutch whose multi-vaned surface clings to steel with twice the friction co-efficient of asbestos or other conventional clutch lining, according to the manufacturer. This new clutch is simple in construction, having only three or four parts, is light in weight, and self-adjusting. Because of the flexibility in the application of its pressure, the Airflex clutch is claimed to provide uniform pressure on every inch of surface and for the same reason has many of the properties of a coupling when it is engaged, and can take care of a reasonable amount of angularity and misalignment. Adhesion is obtained through the friction liners riveted to brass plates which are vulcanized to the clutch gland, on both the expanding and constricting types of clutch.

Two distinct types of lining are used on both types of Airflex clutches. When excessive slippage is encountered and where loads are to be picked up gradually, the use of friction lining is recommended. When the plain squeegee-tread is used, a reasonable amount of slippage can be tolerated if the engagements are not too frequent. A special rotary seal has been developed to deliver air to the clutch, either by entering the shaft at the end or by a straddle-type seal.

A complete line of Airflex clutches is being developed for industrial purposes, such as conveyors, diesel-electric generators and similar uses as well as for engines. The Fawick General Co. has been organized to manufacture these new clutches and is affiliated with the General Tire & Rubber Co. Thomas L. Fawick, inventor of the Airflex clutch, is identified with the company.

North Dakota Vetoes Gas Tax Diversion

At a special election in North Dakota on July 11, measures were submitted to the voters which provided that for a period of two years no contract could be let for new highway construction, the money to be used instead for old-age assistance. Furthermore, all money allocated to the counties (derived from one-half of motor vehicle license fees and from one cent of the state gas tax), previously used for road building, should first be used for the counties' share of the Old Age Assistance Fund, and the balance spent for any purpose the county commissioners might determine.

The voters said "no" to this proposal by a vote of five to one. So the highway construction program may now proceed in a normal way.

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62.5 K.V.A., .8 power factor, 240 volt, 3 phase, 60 cycle, 1200 R. P. M. Columbia revolving field type A. C. Generator with direct connected exciter.

SIZES: 1 TO 300 KVA.
SPEEDS: 1800, 1200, 900, 720, 600, 514, 450 R.P.M.
SHIPMENT: ONE WEEK TO 10 DAYS.

Driven by Diesel or gas engine, Columbia Generators furnish power and light where current is not available and are also used for stand-by service in event of power failure. Compactly built, they are easily portable. Write for bulletin describing their dependable construction.

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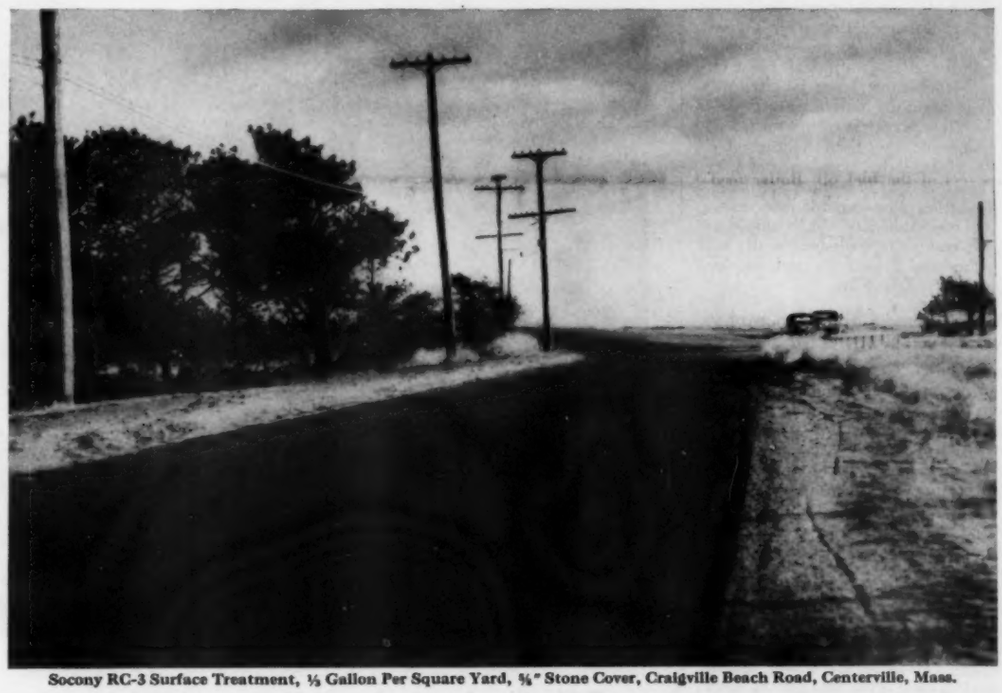

Socony RC-3 Surface Treatment, ⅓ Gallon Per Square Yard, ¾" Stone Cover, Craigville Beach Road, Centerville, Mass.

SOCONY Asphalt Road Oils • Socony Asphalt Joint Fillers • Socony Waterproofing Asphalt • Socony Cut-Back Surfacing Asphalt • Socony Asphalt Binder A for surface treatment • Socony Refined Asphalt for sheet asphalt paving • Socony Cold Patch Asphalt for all types of patching • Socony Asphalt Binders B & C for penetration work (Asphalt Macadam) • Socony Paving Asphalt 51-60 and 61-70 Penetration for the mixing method (Asphaltic Concrete) • Socony Asphalt Emulsions • Specifications and all other particulars furnished on request.

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Snow Removal Problems Vary in New Jersey

(Continued from page 1)

New Jersey has a total length of nearly 1,600 miles, independent of the county and municipal roads within the commonwealth, although interlinked with these other routes. Northeastern New Jersey forms a part of that populous area of the country known as the Metropolitan Zone, with the City of New York as its center. Within that intensely active business, commercial and industrial area, there is a resident population of approximately 12,000,000 people. The interchange of traffic within this area is continuous, and dense at certain peak periods daily. Nearly three-fourths of New Jersey's entire population of 4,500,000 is located within this zone.

The state's primary highways which are tributary to this great center of diversified interests and activities form transportation links over which move tremendous volumes of traffic bound to and from states lying to the south and west of New Jersey. This travel has been increasing rapidly from year to year.

The New Jersey State Highway Department, upon which rests the responsibility of maintaining its 1,600 miles of primary roads fit for service at all times, has amply demonstrated what competent organization, skillful planning, and a wide employment of mechanized equipment can do in dealing with a many-sided problem that affects so intimately and vitally millions of people. The task of removing snow from the highways devolves upon the Maintenance Division of the State Highway Department, and the means and methods employed reflect the cumulative experience of years. The aim has been to employ facilities in each section that would best answer normal conditions and yet be ample and flexible enough to deal successfully with the occasional greater demands imposed by unpredictable Nature.

Varied Climate and Topography

New Jersey has an expanse of 8,224 square miles. The proximity of the ocean normally has a moderating action upon the severity of the local winter weather along the coast. Therefore, the lower tiers of the seaboard counties ordinarily have relatively light snowfalls; but every now and then a heavy blanket of snow may be laid on the usually favored section.

Inland from the coast and beyond the tempering influence of the Atlantic, the snowfalls are as a rule somewhat deeper, and in the mountainous parts of the state the snows are likely to be deep, to occur more often, and are to be expected over a longer period of the winter months. Coastal snows, even though of lesser depth, are more often moist than dry, and a wet heavy snow will hamper and clog some types of equipment usually depended upon to clear the prevalent snows away. Dry and deep snows, which predominate in the interior upland and mountainous sections, present a different problem in snow removal.

The records of the New Jersey State Highway Department show that snowfalls may range all the way from a mere coating to a depth of 50 inches in various divisions of the highway system. From Atlantic City northward, the countryside is often subjected to heavy and obstructing snowfalls; and when the tempering effect of the nearby Atlantic Ocean changes a dry snow to a moist one, the job of clearing the highways is intensified.

Equipment To Meet Conditions

In the mountainous sections of the state, where the snows are usually dry, the State Highway Department depends principally upon V-type or one-way plows to do the clearing, the choice of one or the other being determined by experience in each of the unit highway sections. Graders are not infrequently utilized for snow removal and when so used are temporarily diverted from their regular employment in year-round road maintenance. Rotaries are used in the sections requiring this heavy-duty type of equipment.

Ice and Drift Control

For ice control, the Maintenance Division makes use of cinders, sand and calcium chloride, principally, but occasionally some rock salt is used. The calcium chloride is applied to the stockpiles of cinders, sand or rock dust, about 100 pounds of calcium chloride being the usual allowance for each cubic yard. The Maintenance Division annually makes use of from 10,000 to 15,000 cubic yards of cinders, etc. The stockpiles are located at strategic points, determined by experience, and the size of each pile varies in accordance with the probable needs.

Along cuts through which highways pass, where drifting snow would be

(Concluded on page 38)

RAIL CRANES SHOVELS DRAGLINES ZEE ROTATORS
BROWNING PRODUCTS
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AT YOUR SERVICE FOR THESE PRODUCTS
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CRAWLER, TRUCK AND WAGON DRAGLINES SHOVELS CRANES - HOES
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● You'll enjoy another P&H cost-saving feature if you ever replace a shoe on P&H's tractor-type crawlers. Their cost is but a small fraction of that of ordinary traction treads and you save dollars in replacing time. By removing four bolts you can lift out the P&H shoe without disturbing the crawler track. In addition the P&H tractor-type crawler gives you a smoother, surer, means of travel. Why not learn all about these modern P&H Pacemakers that are "5 years ahead of the field?"

P&H EXCAVATORS 18 Different Sizes From ⅜ to 5 cubic yards Capacity; Gasoline, Diesel or Electric Power

Write for literature on the size and type that interest you. Address the Harnischfeger Corp., 4419 W. National Avenue, Milwaukee, Wisconsin.

HARNISCHFEGER CORPORATION
EXCAVATORS • ELECTRIC CRANES • ARC WELDERS P&H HOISTS • WELDING ELECTRODES • MOTORS

Concrete VIBRATORS AND GRINDERS
Write for Circular on types, sizes and prices
White Mfg. Co.
ELKHART INDIANA

Road Mix and D. B. S. T. On S. C. Highway Job

(*Continued from page 7*)

operation under the lease was about the same as using blades for mixing the aggregates and asphalt.

A 750-gallon Etnyre distributor was used as an auxiliary heater for the asphalt and as a feeder truck. The quantity of asphalt used was 3 gallons of Standard Oil of New Jersey RC-1B 85 to 100-penetration cut-back asphalt per square yard of road surface 5 inches thick. In order to run this 12-foot-wide machine down the road with three windrows it was necessary to blade back the shoulders for 1 foot on either side to accommodate the wheels of the machine at the proper elevation. After the windrows were mixed the patrol graders spread the material by running on two windrows and knocking down the center windrow to left and right and then spreading the two outside windrows toward the center. The road-mix material was compacted by traffic alone, with continuous blade maintenance.

Surface Treatment of Road-Mix

The road-mix material, after blade maintenance had been completed and the base was thoroughly compacted by traffic, was given a single bituminous surface treatment. The surface was shot with 0.35 to 0.38 gallons per square yard of 150 to 200-penetration asphalt at 320 degrees F. Over this 30 to 33 pounds per square yard of stone from ⅞-inch to 10-mesh was spread with Gibbes spreader boxes and immediately keyed in by rolling with a 5-ton Galion gas roller.

The Sand-Clay Section

The subgrade material for the 17-mile sand-clay section was taken about 75 per cent from pits and 25 per cent from the ditches, using material with less than 25 per cent clay. The material was spread, bladed and compacted, using a LaPlant-Choate bulldozer and a Caterpillar Fifty diesel, and a Caterpillar Forty and a RD7 pulling a Caterpillar 66 and an Austin-Western grader with 12 and 10-foot blades respectively. There were also two Caterpillar Auto Patrols with 12-foot blades. The material was compacted by a Bros sheepsfoot roller and on certain sections where compaction was not completed during the grading operation, by pulling a loaded 6-yard Carryall scraper over the subgrade. The subgrade was maintained by this equipment until satisfactorily compacted. It was then fine-graded and sand-clay from selected pits was placed on the road. The sand-clay was compacted by traffic and by a Bros rubber-tired roller. Due to the absence of the usual precipitation a truly religious attitude was developed by all those connected with the job and they constantly "prayed for rain."

Bituminous Surface Treatment

The sand-clay base for the entire 17 miles received a double bituminous surface treatment, starting with a coal-tar prime of 0.3 to 0.35 gallon per square yard. The tack coat consisted of 0.4 to 0.45 gallon per square yard of 150 to 200-penetration asphalt applied at 320 degrees F. Over this 1½ to ¼-inch stone was spread from boxes built into the tail-gates of trucks, at the rate of 47 to 50 pounds per square yard. The first seal consisted of 0.17 to 0.18 gallon per square yard of Standard Oil of New Jersey RC-1B cut-back with a penetration of 85 to 100, applied cold. Stone from ⅝-inch to 10-mesh was then spread on the road at the rate of 17 pounds per square yard and then the second seal of the same cut-back asphalt applied at the same rate. The surface was then mixed by dragging with gang brooms and when thoroughly mixed was rolled with the 5-ton Galion gas roller and opened to traffic about 5 days later when the surface had cured and there was no pick-up under rubber-tire traffic.

Personnel

The contract for the 28 miles of road-mix and sand-clay bases with single and double bituminous surface treatment respectively was awarded to MacDougald Construction Co. of Atlanta, Ga., on its low bid of $363,575.21. F. D. Nichols was Superintendent for the contractor and F. W. "Jitney" Ford was Resident Engineer for the South Carolina State Highway Department.

New Bulletin on Power Subgrader

The R-B power Finegrader, which is now manufactured by the Buckeye Traction Ditcher Co., Findlay, Ohio, and sold through the R-B Equipment Division, 228 No. LaSalle St., Chicago, Ill., is described and illustrated in a new catalog recently issued by that company. This power-operated subgrader, which builds accurate subgrade in any kind of soil, was designed and built by a contractor and is available in three models for 8 to 11-foot, 10 to 13-foot, and 18 to 22-foot pavement widths.

Copies of this new bulletin may be secured by interested contractors and engineers direct from the manufacturer.

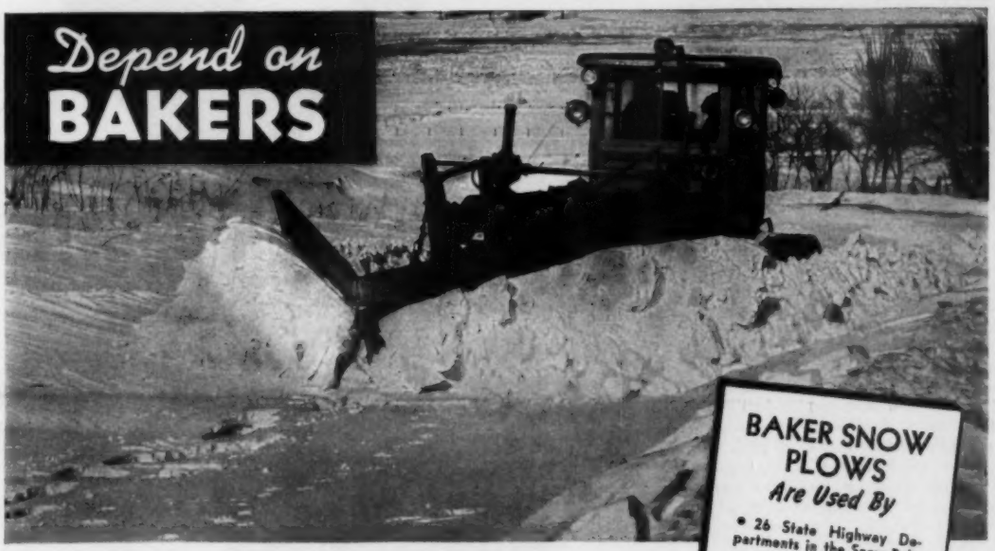
New Sales Representative For Western Cataphote

Announcement has been made by the Western Cataphote Corp. of the appointment of A. B. Moore as sales representative in the southern states. Mr. Moore, who has a background of many years' experience in reflecting-sign and highway-traffic problems, will make his headquarters in Atlanta, Ga.

"AT THE WORLD'S FAIR"

"FLEX-PLANE" vibrated screeding machine is being used on the world's most modern highways, airports and elevated roadways. There's a reason why World's Fair visitors at New York will find a "FLEX-PLANE" machine has been used to build those super roadways in and around New York City's Metropolitan area.

FLEXIBLE ROAD JOINT MACHINE CO.
WARREN, OHIO



Baker Snow Plows have been clearing streets and highways since 1908. Naturally, responsible officials choose Bakers when they want dependable performance.

Originators of tripping blades on truck plows, pioneers in hydraulic operation and other advanced ideas, Baker builds today's plows even more efficient and durable to keep pace with modern motive power.

Baker truck plows are available in 21 models—"V" and tripping blade types—all with convenient hydraulic hook-up to fit snugly on any motor truck. There are also hydraulic snow plows for leading industrial tractors, large and small, as well as for motor patrols. You can depend on Bakers for a real snow moving job.

BAKER SNOW PLOWS
Are Used By

- 26 State Highway Departments in the Snow Belt.
- Important cities, including New York, Boston, Chicago, Cleveland, St. Paul and others.
- Nationally known industries such as Ford Motor Co., General Electric Co., Eastman Kodak Co., General Motors and scores of others.
- U. S. Military Academy, University of Wisconsin, Phillips-Exeter Academy, University of Illinois and other educational institutions.
- Chicago Surface Lines, Erie R.R., Port of New York Authority and many other well known public utilities.
- Grand Canyon, Zion and Glacier National Parks and numerous governmental departments.

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SNOW PLOWS

THE BAKER MFG. CO.
585 Stanford Ave., Springfield, Illinois

Write for Baker Snow Plow Bulletins. Give name and model of truck or tractor.

One of several hundred Baker Snow Plows owned by the City of New York.

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SNOW PLOWS
SCRAPERS
MAINTAINERS

BULLDOZERS
GRADEBUILDERS
ROOTERS

The New Model P 11-Yard Carryall

New Model Scraper

Incorporating all the features of previous Carryall models, the new Model P single-bucket scraper, recently announced by R. G. LeTourneau, Inc., Peoria, Ill., and Stockton, Calif., has in addition several new features of design and construction, including light weight for greater capacity, higher sides to retain all of the load, a stronger yoke, and a new tail-gate sheave arrangement.

The tail-gate sheaves are placed on the sides of the bowl, instead of on the top, in order to keep them free of dirt, sand and gravel and to control the tail gate more efficiently from the center of the load rather than the top. A positive ejector tail gate, cable controlled, gives regulated dumping in any required thickness, and fractional-inch control of the cutting blade results in a greater margin of scraper usefulness, according to the manufacturer.

Extra high sides on the scraper bowl retain the extra pay yards that may be wasted over the sides with big loads. A new curved yoke strengthens the entire assembly and eliminates stress points. Five box beam channels are built into the sides of the bowl for additional strength and ruggedness. On the rear is a drawbar hitch that can be used for either a pusher block or a hitch for tandem scraper operation. The Model P, like all LeTourneau equipment, is constructed from a special-analysis steel and is arc welded throughout.

The Model P is one of a complete series of LeTourneau scrapers built with an 8-foot 6-inch cutting blade, complementing the line of 10-foot blade Carryalls. For many jobs and conditions, contractors prefer this narrower type of scraper.

Reflector-Button Markers For Highway Center Lines

The Van A. Hamilton system of marking highways, using the Hamilton safety reflector marker, is described and illustrated in a bulletin issued by Van A. Hamilton Products, Palestine, Texas. Available in red, green or yellow colors, these reflector markers are visible for over 1,000 feet at night, according to the manufacturer. Placed 30 to 40 feet apart, they appear as a line to the driver, and being colored they are effective as a center-line marking in the daytime as well as at night.

A transverse undercut makes these markers self-cleaning, they will not damage tires as they are very low, and the manufacturer states that it costs less than $100 a mile for complete installation.

Literature on this system of marking highways and danger points may be secured by interested state and county highway engineers direct from the manufacturer by mentioning this item, or from this magazine.

New Plywood Factory

The Pacific Plywood Corp. has announced the opening of its new plywood factory at Willamina, Ore., about 55 miles west and south of Portland. This location was selected for its strategic location to a fine stand of Douglas fir timber which will supply the factory with logs.

Officers of the company, all of whom have had considerable experience in successful Douglas fir plywood production, are M. Sekstrom, President and Chairman of the Board; E. S. Wentjar, Vice President and General Manager; V. K. Wright, Secretary and Treasurer, and H. J. Nunneley, Sales Mgr.

New 3/4-Ton Truck

A new ¾-ton V-8 truck for pick-up service, increasing to forty-nine the body and chassis types included in the Ford V-8 truck and commercial car line, was recently announced by the Ford Motor Co., Dearborn, Mich. The new truck has a 122-inch wheelbase chassis and is available with panel, express, stake and platform bodies and as a chassis with cab, chassis with cowl and chassis with windshield.

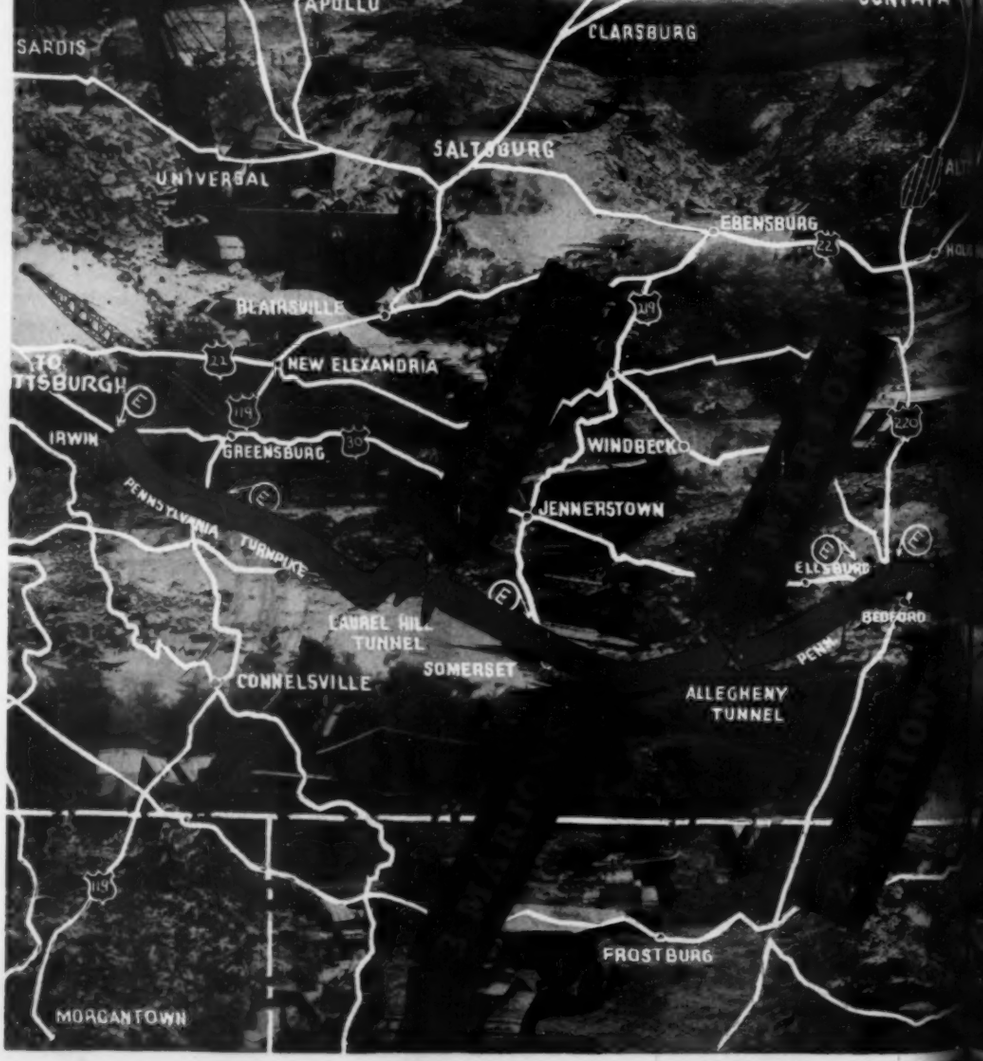
The rear axle is full-floating, which means that all weight supported by the rear springs is transferred to the axle housing and none is supported by the axle shafts. The hydraulic brakes are 12 inches in diameter and 1¾ inches wide, front and rear, giving a total drum area of 264 inches and brake lining area of 162 inches. The wheels have full drop center rims 16 x 5 inches and carry 6:50-16 six-ply tires in front and 7:00-16 six-ply tires on the rear wheels.

A 60-hp engine, with a 6.67 to 1 rear-axle gear ratio, or an 85-hp engine, with 4.11 or 4.86 to 1 rear-axle ratio, is available. A three-speed transmission is standard and a four-speed transmission is available at extra cost.

Want information on equipment? Write the Editor.

19 MA

SPEED UP CONTRACTS ON THE NE



Instruments for Testing Cement, Soils, Petroleum

A new 164-page catalog, covering its line of instruments for testing cement, soils, and petroleum and its products, has just been issued by the American Instrument Co., 8012 Georgia Ave., Silver Spring, Md. The Cement Section includes information on instruments for testing portland cement, concrete, mortar, aggregates, lime, and gypsum, while the Soils Section deals with the testing of the mechanical stability of soils and includes the latest developments in instruments used by civil engineers and materials testing laboratories. The Petroleum Section is devoted to the testing of crude and refined petroleum, greases and lubricating oils, bitumen, asphalt, tar, creosote and similar products.

Interested contractors and state and county highway engineers may secure copies of this Catalog CY15 without charge by writing to the manufacturer on their business or official stationery.

New Arc Welders

The new Sight Feed alternating-current arc welders, recently announced by the Sight Feed Generator Co., Richmond, Ind., are described and illustrated in a new bulletin just issued by that company. This new welder is designed for all types of arc welding and is easily set up and made ready for service. Features include maintained amperage, secured by the scientifically constructed transformer; air-cooled coils to permit maximum cooling; short circuiting current to eliminate sticking or surges on the power line; arc stability; and no moving parts.

These welders, all of which are equipped with an 8-foot power cord and plug, 20-foot welding cable, electrode holder and helmet as standard accessories, are available in four 60-cycle 220-volt single-phase models. Copies of the new bulletin with full information on these welders may be secured direct from the manufacturer.

ARIONS

E NW PENNSYLVANIA TURNPIKE

The speed with which tremendous yardage must be handled in building the new 161 mile Pennsylvania Turnpike has resulted in many of the prominent contractors on the job Modernizing with Marions. Sixty per cent of all tunnel excavating is being handled by Marion excavators as well as many miles of grading and drainage. It is Marion's speed – plus proven performance that resells Marion owners time and time again – and has put nineteen Marions, mostly new machines, on the Pennsylvania Turnpike.

THESE TURNPIKE CONTRACTORS MODERNIZED with MARIONS

Guthrie-Marsch-Peterson Co.
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Allegheny Tunnel and East and West Approaches—other structure grading drainage contracts.

Mason & Hanger Company
2 MARIONS
Rays Hill Tunnel and East and West Approaches.

Arundel Corporation
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4 MARIONS
Kittatinny and Blue Mt Tunnel and East and West Approaches.

Central Pennsylvania Quarry, Stripping & Construction Co.
4 MARIONS
Structures, grading and drainage along 7.27 miles of roadway extending east from the Allegheny Mountain Tunnels.

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East Approaches of Blue Mt Tunnel.

Ferguson & Edmondson
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New Stanton Viaduct—grading and drainage and other contract

C. J. Langenfelder & Son
1 MARION
Structures, grading and drainage.

Write for Bulletins describing the size and capacity of the Marion in which you are particularly interested, and a copy of the latest GROUNDHOG.

THE MARION STEAM SHOVEL CO.
MARION, OHIO, U. S. A.

SHOVELS — DRAGLINES — CRANES
CLAMSHELLS — BACKHOES

Curing Concrete With Cotton Mats

The Life of Mats Tested By Texas Highway Dept.; Results Compared With Other Curing Methods

✦ TO determine the cost per square yard of curing concrete pavement with saturated cotton mats in comparison with other methods of curing, the Texas State Highway Department has carried on a number of experiments to determine the number of square yards of pavement a cotton mat would cure before wearing out.

On December 21, 1933, seven cotton mats were placed on a section of State Highway 2 in Bell County where concrete pavement was under construction. The mats were used along with the 10-day wet-burlap wet-earth method of curing specified in the contract. The saturated mats were placed on a section of freshly finished pavement and kept dripping wet for a minimum of 72 hours, then moved forward and placed on another freshly finished section, and so on until the project was completed. The pavement between the cotton-mat-cured sections was cured with 10 days of wet-burlap wet-earth.

These mats were used continuously on this project and on an adjoining state project until the concrete pavement was completed on May 8, 1934, and served on 21 placements. The mats then were allowed to dry on the pavement and were stored in the basement of a building on a concrete floor until June 13, 1934, when they were shipped to Gonzales County to be used on a 16-mile project. On June 25, 1934, the seven mats were saturated and placed on the freshly finished concrete. Throughout this project, the mats remained on each placement a minimum of 72 hours, and then were moved forward until the project was completed on October 6, 1934, serving a total of 19 placements. When the mats were removed from some of the placements, the pavement was sprinkled with water for 3 days thereafter to determine the effects of sprinkling on the concrete.

Test Curing Methods

Ten methods of curing were employed on this project for comparisons of the efficiency and cost of the different methods, as follows:

1. 24.6-ounce cotton mats kept dripping wet for 72 hours, then removed and no subsequent sprinkling of pavement.
2. 24.6-ounce cotton mats kept dripping wet for 72 hours, then removed and the pavement sprinkled twice daily for an additional 3 days.
3. 12-ounce cotton sheets, double thickness, kept dripping wet for 144 hours.
4. 12-ounce cotton sheets, double thickness, kept dripping wet for 72 hours, then removed, and pavement sprinkled twice daily for an additional 3 days.
5. 12-ounce cotton sheets, double thickness, kept dripping wet for 72 hours, then removed, and no subsequent sprinkling.
6. 12-ounce cotton sheets, single thickness, kept dripping wet for 144 hours.
7. 12-ounce burlap sheets, double thickness, kept dripping wet for 72 hours, then removed, and pavement sprinkled twice daily for an additional 3 days.
8. 12-ounce burlap sheets, double thickness, kept dripping wet for 72 hours, burlap removed and no subsequent sprinkling of pavement.
9. 8-ounce burlap sheets, triple thickness, kept dripping wet for 72 hours, then removed and pavement sprinkled with water twice daily for an additional 3 days.
10. 10-day wet-burlap wet-earth, as per original specifications.

No appreciable benefits could be found in the 72-hour sprinkling of the pavement after the coverings were removed. A comparison of the compressive strengths of the concrete cured by the different methods shows that the minimum and average strengths of the concrete cured with the cotton mats were the highest.

Method No. 1 cost 3.4 cents per square yard of pavement. Method No. 4 cost 2.94 cents per square yard; Method No. 6, 3.6 cents; Method No. 7, 3 cents; and Method No. 10, 4 cents.

When this project was completed, the cotton mats were allowed to dry on the pavement and then were shipped to another project in Bexar County where the concrete pavement under construction was being cured with cotton mats owned by the contractor. On October 15, 1934, the seven test mats were again saturated thoroughly and placed on the pavement, along with the contractor's new cotton mats. They were used in the same manner as on the Bell County project, but the pavement was not sprinkled after the mats were removed. When this work was completed on November 13, 1934, the test mats had served 8 placements on this project. They then were allowed to dry thoroughly on the pavement and, on November 20, 1934, were stored in

(Concluded on page 28)

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The New Osgood Type 60 Combination Shovel, Dragline and Crane

New 1¼-Yard Excavator

A new combination shovel, dragline and crane in the 1 to 1¼-yard class has recently been announced by the Osgood Co., Marion, Ohio. This new machine is designated as the Type 60 and is available as the Model 600 with a 20-foot boom, 16-foot handle, 1-cubic yard dipper, 100-hp gasoline engine, and 11-foot 10-inch crawlers. As Model 605 the unit is equipped with a 21-foot boom, 16-foot handle, 1¼-cubic yard dipper, 120-hp gasoline engine and 12-foot 3-inch crawlers. Diesel power may be substituted for the gasoline engine.

While the Type 60 has a number of new features, several of the standard Osgood features such as unit cast-steel construction, the Servo control of drum-shaft clutches, vacuum control of swing and travel clutches, safety fuel tank, high pressure lubrication, and silent chain power transmission, are incorporated in the new machine. A liberal use of special steels has been made in the Type 60. The shafts are of Hy-Ten and vanadium steels, the propelling gears are of chrome, the crowding racks and dipper lip and teeth are of manganese, and the clutch housings of polished nickel iron. All high-speed shafts are mounted in anti-friction bearings; the vertical swing shaft has a square section, top and bottom, and no keys are used; and the mitre and spur gears above deck are of alloy steel, the teeth cut from solid blanks, and heat-treated.

A new feature is the bolting on of clutch and brake housings on the drum shaft. The drums are of cast steel and the bands, of the outside contracting type, are in halves for easy replacement, and are lined with molded blocks.

In shovel service an independent chain crowd unit is mounted on the main body casting. The chain sprocket at the boom foot is in line with the boom-foot hinge pins, making the crowd chain tension self-adjusting at all boom angles. The shovel boom and handle are of all-steel box girder type, electrically welded. The crane booms are of the box type with heavy chord angles and pipe lattice, all electrically welded, and made in two sections for ease in handling and for insertion of lengthening units.

Continuous tread crawler trucks are propelled by two roller-type drive chains, each with a tensile strength of 112,000 pounds. The tread links are of alloy steel and the link pins are full floating. A large-diameter centering gudgeon relieves the vertical travel shaft of all lateral stresses.

Illustrated descriptive specifications of this new unit as Model 600 and 605 are available and may be secured direct from the manufacturer or from this magazine.

Contractors' Equipment

The complete line of Lansing equipment for contractors, including concrete and mortar mixers, hoists, wheelbarrows and concrete carts, all available in a variety of styles and sizes to meet the needs of contractors on construction jobs, is described in detail and illustrated in a very complete catalog recently issued by the Lansing Co., Lansing, Mich.

Copies of this catalog called "Lansing Equipment for Contractors" may be secured by those interested direct from the manufacturer by mentioning this item, or from this magazine.

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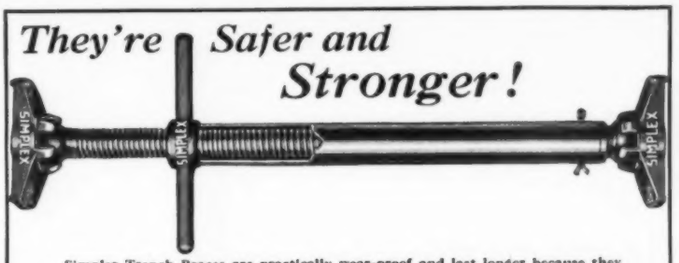

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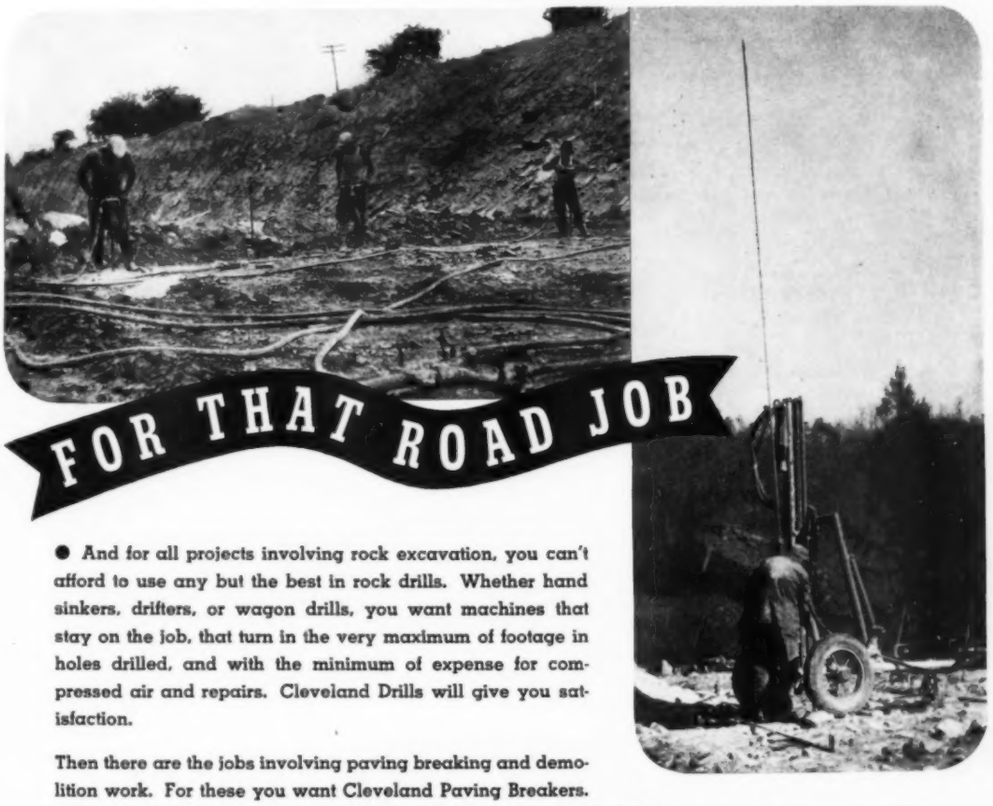

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C. & E. M. Photo
Concreting the Deck of the New Overpass for Galveston Causeway Traffic

Form Work Feature Of Texas Overpass

(*Continued from page 2*)

noted because of the longer spans. A somewhat serious complication in the foundations of the first bent north of the 45-foot span was caused by the proximity of a 30-inch cast iron water main from Alta Loma carrying the main supply for the city of Galveston. The work was carried on in such an expeditious manner that there was no trouble and no interruption of the water supply for Galveston.

Before excavation for the footings began at the railroad crossing the pits were sheeted. The steel sheeting was driven 15 feet deep and braced with 12 x 12 wales and interior bracing of 12 x 12's. An Owen ¾-yard clamshell was used on excavation and was handled by a P & H 600 crane.

The Columns and Caps

The columns at the railroad crossing are 43 inches square and at the other bents 36 inches square. An interesting feature of the design that was of considerable benefit to the contractor in the re-use of his column forms was that there were no fractions of feet in the lengths of the columns measured from the bottom of the footings. This also expedited the steel design and handling. When the column forms were moved from one bent to the next away from the center section one foot was cut off the length. In practice it worked out that 2 feet was cut off as the forms could not be readily used on an adjacent bent except in alternate pours. At the railroad crossing the columns were all of uniform height.

The concrete caps over the 3-column bents are 4 feet 9 inches high at the center and arched to 7 feet 6 inches at the ends. This soffit curve forms an ellipse, the minor axis being the difference between the maximum and minimum depth of the cap and the major axis being one-half the distance between the columns.

For the bents at the railroad crossings the concrete caps were omitted and 33-inch, 141-pound I-beams were used instead.

Concrete and I-Beam Floor Girders

The concrete floor girders for the typical spans are five in number under each roadway, 13 inches thick, and of variable height to care for the crown of the road. They carry the 6¾-inch reinforced concrete deck. At the railroad crossings the deck is 7 inches thick and is carried on 30-inch I-beams of 45-foot span. The two outside I-beam floor beams are 124 pounds per foot and encased in concrete while the eight inside beams are 116-pound.

At either side of the deck there is a 12-inch concrete curb with a 7½-inch radius to prevent excess wear on tires when run against the side of the road. It was the original idea to have a 4-foot grass plot in the center but the excessive cost of maintaining it even with the use of automatic sprinklers caused it to be abandoned. Consequently there is a hole running the entire length of the structure which was to have been filled with earth. This opening is covered with a 4-foot slab of reinforced concrete 4 inches thick. Two layers of roofing felt separate the slab and the shoulders on which it rests so that it may be easily removed if desired for future construction.

The deck girders are fixed toward the ends of the bridge and rest on 9 x 13-inch cast steel bearing plates at the free ends and 8 x 13-inch plates at the fixed ends.

Column Forms

The column forms were built in single sections for each side of the typical columns of 1-inch lumber lined with 3/16-inch Masonite and with 2 x 6-inch studs on 16-inch centers from top to bottom and 4 x 4's as locks, using 5,000-pound Bates ties. On the larger columns the same material was used except that extra 2 x 6 locks were used at the center of the columns and the ties extended through the concrete.

The attractive fluted corners of the columns and the fluted tracery on the outer faces added much to the interest of the structure. To secure the fluted corners 3 x 6's and 3 x 9's were bolted to the corners of the forms and oiled with the forms, leaving clean angles. The 2-inch top fluting was secured by nailing a 2-inch half round in the forms.

Pouring the Decking

The forms for the decking were supported by piles driven ahead of the work. The contractor's schedule was set for the pouring of three slabs per week, one slab equalling half the roadway. In pouring the deck 4-foot runways were used, carried on 4 x 4 posts to the bottom of the forms so as not to interfere with the reinforcing. One runway was placed down the center and another down the side nearer the edge with two cross-overs and two spurs for pouring the curb. The spurs and cross-overs were moved as the pouring progressed from the lower to the upper part of the slab according to the grade.

The concrete was batched dry in a Heltzel 110-ton plant equipped with a Kron dial scale and served by a 20-ton Brownhoist steam locomotive crane. The batches were hauled by a pair of light

(*Concluded on next page*)

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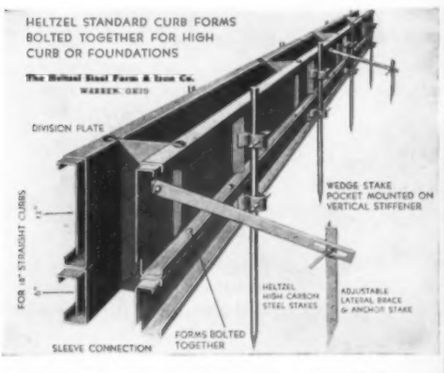
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After the trench material has been rolled, the entire width of the road is usually resurfaced. Then Galion tandems (left) are used for compacting the final surface treatments. 3 sizes of Galion tandem rollers with variable weight range from 5 to 14 tons. Send for data.

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Galion Ohio

C. & E. M. Photo
Placing Fill With a Browning ½-Yard Dragline on the Approach to the New Overpass Near the Galveston Causeway

Overpass Construction Near Galveston, Texas

(Continued from preceding page)

single batch trucks and mixed in a Koehring 27-E paver run alongside the structure. The concrete was delivered direct to an Insley bottom-dump concrete bucket and raised to the deck by a P & H 400 crane and dumped into the three rubber-tired buggies direct. The concreting crew consisted of three men wheeling, one man dumping the bucket, two men shoveling, six puddlers, and the foreman. A baffle plate held by one of the puddlers was used to guide the concrete from the buggies direct into the girders until they were filled. No vibration was used with the concrete. It was cured with cotton mats kept wet for 8 days.

To insure a smooth bridge deck the contractor built a 42-foot screed with a bottom strike-off consisting of a continuous 2 x 8 timber. This was adjustable for truing by pairs of bolts spaced 2 feet apart for the entire length of the screed. The support for the strike-off is a truss of 2 x 4's for the top chord and 2 x 6's for the bottom chord and 2 x 4 diagonals and verticals. The whole truss was bolted together. It was built entirely of fir lumber.

For the installation of the colored concrete center stripe the contractor used a simple device that insured a clean line the entire length of the bridge. The device consisted of a pair of 1 x 4 plank dressed with a strip of 16-gage metal 1 inch wide screwed to the edge of the planks on the inside and protruding 3/16 inch to cut the edge of the line clean. It was placed in position just after the concrete had set sufficiently for a man to get on it and then a wood float was used to work in the magnetic oxide to form the 6-inch black stripe. A pair of blocks at the end of each section of the stripe spacers acted as locks to hold the next spacers firmly against the concrete.

The average dry loose batch weights for the concrete used throughout the structure were: 955 pounds of sand, 1,681 pounds of gravel, and 5 bags of cement per batch (the design used a cement factor of 6).

Dredged Approach Fills

The subcontract for the pumped approach fills was awarded to the Gulf Coast Dredging Co. of Texas City, Texas. The 58,000 yards of fill was placed with a 16-inch hydraulic dredge. The final shaping of the fill was done with a Browning ½-yard and a P & H ¾-yard dragline.

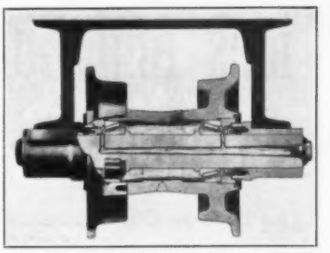
Personnel

The work on the overpass, FAGS-78A, (1) was started on July 28, 1938 and, in spite of a long period of rains which turned the low area into a mud hole, the Austin Bridge & Austin Road Co., of Dallas, Texas, which received the contract on its bid of $338,400.72, completed the work within the allowed 180 working days. Joe W. Grace was Superintendent for the contractor, with L. A. Peterman, Resident Engineer, and S. P. Gilbert, Junior Resident Engineer, for the Texas Highway Department.

New Track Roller

A new positive-seal truck-wheel assembly for crawler tractors which is designed to eliminate daily roller greasing has just been announced by the Allis-Chalmers Mfg. Co., Tractor Division, Milwaukee, Wis.

In this new truck-wheel assembly, ordinary bearings are replaced by tapered roller bearings with a positive-seal arrangement that keeps in lubricating oil and keeps out dirt, dust, mud and grit. According to the manufacturer, lubrication is required only once every 200 operating hours instead of every 8 hours. In addition, this new arrangement is so constructed that all of the old oil is forced out each time the assembly is lubricated.



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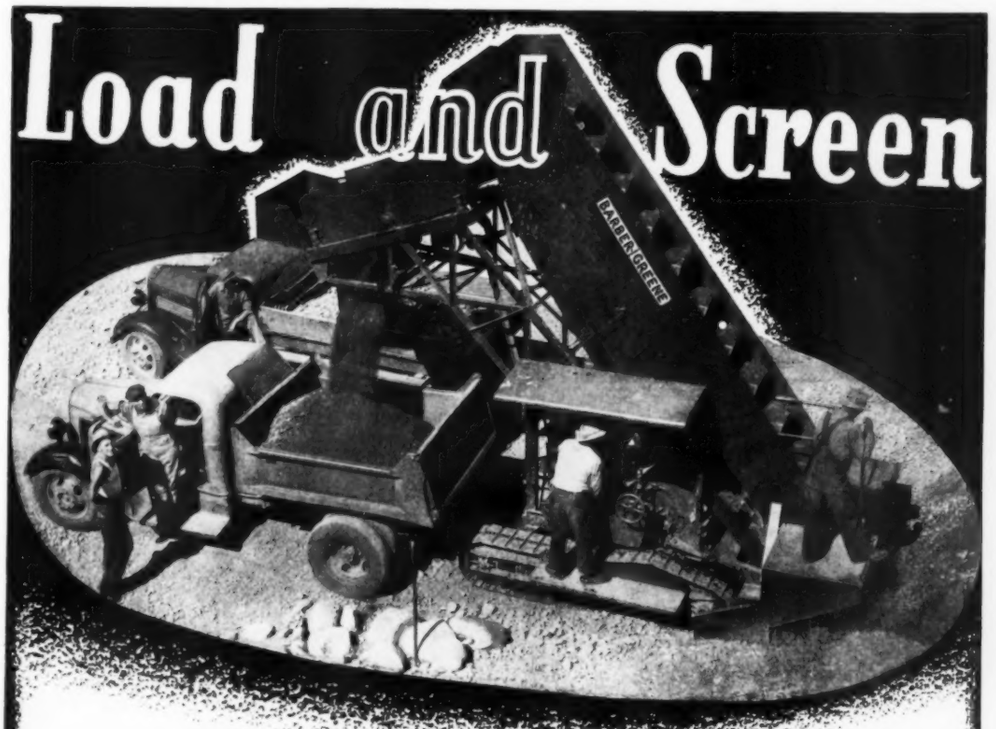

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Low Cost-High Quality Road Construction

Tides and Currents Present Problem on Narrows Bridge

Open Dredge Caissons Used For Two Piers of 5,939-Foot Suspension Bridge Near Tacoma, Wash.

By HENRY W. YOUNG

(*Photo on page 40*)

✦ THE Narrows Bridge now being constructed across an arm of Puget Sound near Tacoma, Wash., will connect the industrial city of Tacoma with the peninsular territory across a branch of the Sound, connecting directly with the present highway to Bremerton where the Bremerton Navy Yard is located. Access to the peninsula from Tacoma is at present by ferry only, except for a long devious route. The bridge is one of the Washington Toll Bridge Authority projects, and is being financed by a PWA grant of $2,880,000 and an RFC bond issue of $3,500,000, making a total of $6,380,000. Construction is being carried on by three contractors acting jointly, the Pacific Bridge Co. of San Francisco, Calif.; General Construction Co. of Seattle, and Columbia Construction Co. of North Bonneville.

Description of the Bridge

The total length of the bridge will be 5,939 feet, of which 5,000 feet is suspension, and is divided as follows:

East anchorage	170 feet
East approach	175 feet
East side suspension span	1,100 feet
Main suspension span	2,800 feet
West side suspension span	1,100 feet
West approach	450 feet
West anchorage	144 feet

The central channel opening is 2,700 feet horizontally and 195 feet vertically, with the east and west openings respectively 650 feet and 1,030 feet horizontally. The bridge will carry a 26-foot concrete roadway and two 5-foot concrete sidewalks. The load capacity is two lines of 20-ton trucks. The approach grade is 2.589 per cent.

The two main piers are of the bottom-door reinforced-concrete caisson type, 118 feet 11 inches long and 65 feet 11 inches wide. The height of the east pier will be 223.09 feet and of the west pier 198.09 feet.

Over each pier, when founded and capped with concrete, will rise two main towers of structural steel, 19 feet x 63 feet in plan at the bottom, 18 feet x 52 feet at the top, and 425 feet high. Each will weigh 1,875 tons. The bridge is to be carried by two 17¼-inch cables, 39 feet on center. Each cable will contain 6,308 No. 6 wires and the total weight of the main cables will be 3,817 tons. The cable anchorage consists of a block of concrete containing 25,000 cubic yards and weighing 52,500 tons.

Some of the quantities involved in the project are:

Excavation (wet)	53,000 cu. yds.
Excavation (dry)	137,850
Structural steel	20,650,000 lbs.
Concrete	111,380 cu. yds.
Reinforcing steel	3,500,000 lbs.
Cable, wire and fittings	8,500,000 lbs.
Concrete pavement	5,200 sq. yds.
Pier fenders, timber	1,230,000 b. f.

Caisson Construction

Steel work on the caissons was fabricated by the Pacific Car & Foundry Co. of Seattle at its Renton plant. The caissons are cellular in construction and of the open dredge type. The cellular sections around the outside measure approximately 12 x 13 feet, except for the four triangular corner sections. There are 20 cells altogether.

The caisson exterior and all cell walls are encased with concrete. The central part of the caisson is also composed of cells, but built up with reinforcing steel and not around structural steel.

The framework is of standard carbon structural steel, riveted. The verticals are principally of two 7-inch x 9/16-inch angles for the interiors and two 8-inch x 6-inch x 1-inch for the exteriors, the latter tapering toward the top to two 8-inch x 4-inch x ¾-inch. Cross members range from two angles 7-inch x 4-inch x ⅝-inch to 6-inch x 4-inch x ½-inch. Diagonals range from two 8-inch x 6-inch x 15/16-inch to two 5-inch x 5-inch x ⅜-inch at the top.

Girts on 12-foot centers are riveted clear around the structure, these girts being 18-inch I-beams, 47 pounds to the foot. These are bolted to the steel framework, and the outer flange supports the wooden sheathing by means of special clips bolted through and through with large head bolts. The sheathing forms the outer form for the concrete shell.

Cutting edges are provided at the bottom of the caissons. When landed in the vertical position, the great weight bearing on the cutting edges forces the caisson down as material is dredged up through the cells by clamshell buckets operated from derricks above.

Sheathing for the caissons was fabricated in sections bolted up at 3-foot intervals with ¾-inch tie rods. Each section is 24 feet long, made of 8 x 12's sized. The thickness is, therefore, approximately 7½ inches.

Steel work was assembled for the first four 12-foot sections of the caisson. A false bottom was then constructed

Dumping One of the Concrete Anchors

around the first section and the concrete poured, forming a hull on which the structure thus far could be floated and towed to the site. When that point was reached, the false bottom was removed, exposing the cutting edges, and the work of building on at the top and sinking the caisson proceeded.

Tide Problem and Anchorage

Both caissons landed in approximately 140 feet of water at high tide, the west pier being then founded 175 feet below the surface at low tide and the east one 200 feet below. Right here the contractors met with their first problem, that of depth. While the open dredge type of caisson has been quite commonly employed, it has not before been used at such great depths.

The next problem was the tidal currents which swirl through the Narrows, the velocity at times reaching 7½ miles per hour, and the tidal range being about 17 feet. It was necessary, therefore, to take unusual precautions with the anchoring of the caissons as they were built and sunk, so that they would land on exactly the right spot and in vertical position.

Twenty-four anchors are used on the west pier and 28 on the east. Each an-

(*Concluded on page 37*)

PORTABILITY and CAPACITY

COMBINED IN THE NEW MODEL P-A PORTABLE MIXING PLANT

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BENDS 7 SIZES OF PIPE WITH ONE PORTABLE UNIT

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NO JACK KNIFING — No loose extension bars, tension arms and ram collars . . . the bending frame is ONE sturdy unit.

SPEEDY SET-UP — New "Pull-Pins" eliminate bolts, nuts and monkey wrenches.

LIGHT WEIGHT — Bending frame and ram, with 4" set-up, weighs only 128½ lbs.

ROLL TO THE JOB—Pilot shoes also serve as wheels for rolling bender along floor.

POWERFUL HYDRAULIC UNIT — 20-ton all-directional ram coupled with high-pressure swivelled hose and hand operated pump (Ram also used with special attachments for pulling pulleys, gears, etc., and for wide range of heavy lift, press and push jobs).

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BLACKHAWK
WORLD'S LARGEST MANUFACTURER OF HYDRAULIC JACKS

The New Transarc Arc Welder

New A-C Arc Welder

According to the manufacturer, the features of the new Transarc alternating-current arc welder recently announced by Hobart Bros. Co., Box CE, Troy, Ohio, greatly broaden the application of welding in garages, field repair shops, welding, blacksmith and truck fleet repair shops and for general maintenance and repair work. This new welder has a range of 20 to 200 amperes and is for use on 220 single-phase power lines.

Features include the elimination of electrical or mechanical connections between the power lines and welding leads, high efficiency, stable arc because of the special inbuilt construction whereby the arc-holding voltage increases as the welding rate is reduced, and the welding current adjusted in a large number of steps. The unit is equipped with hand grips on each side, is mounted on hard-rubber ball-bearing casters, and is furnished complete with electrode and ground cables, electrode holder and ground plate, head shield, wire brush, assortment of Hobart electrodes, and power cable and plug.

An attractive two-color circular describing this unit in detail may be secured by those interested direct from the manufacturer or from this magazine.

New Motor Generator For Electric Shovels

Because of the severe service to which electric shovels are subjected, the maintenance of their motor-generator sets, which usually consist of an alternating-current motor coupled to two or three direct-current generators, becomes somewhat of a problem. In order to provide a remedy for this, the Westinghouse Electric & Mfg. Co., East Pittsburgh, Penna., has brought out a new motor-generator set containing improvements which are designed to provide longer periods of trouble-free service and easier, quicker inspection and repair.

The foundation on which this new set rests is flexible, thereby making the set itself flexible. Each machine of the set is provided with its own bearings and all are connected by flexible couplings of a new type especially developed for this service. In addition to providing flexibility and a means of assuring alignment, the two halves of the coupling are built to facilitate assembly and disassembly in their crowded locations. Grease-lubricated ball bearings of a new sealed type prevent the entrance of dirt either while in service or when removed from the housing. To facilitate assembly and disassembly of the generators, the frames, brush-holder yokes and bearing housings are split horizontally.

New Tool Catalog

Armstrong Bros. Tool Co., 315-357 No. Francisco Ave., Chicago, Ill., has just issued a new general catalog covering its complete line of tools, including Armstrong tool holders, socket wrenches, clamps, lathe tools, ratchet drills, bits, blades and high-speed steel, setting up tools and pipe tools.

Copies of this Catalog No. C-39 may be secured by those interested direct from the manufacturer or from this magazine.

New Motor Grader Catalog

Adams No. 20, No. 302 and heavy-duty No. 50 and No. 51 motor graders are described and illustrated in a new catalog recently issued by the J. D. Adams Co., Indianapolis, Ind. The No. 20 is of light construction for oil-mix and maintenance work, the 302 is designed for all types of maintenance and construction work, including bank cutting, while the No. 50 and No. 51 are built for heavy-duty service. All of these graders are available with snow plows for winter maintenance.

Copies of this new catalog may be secured by state and county highway engineers and contractors direct from the manufacturer by mentioning this magazine.

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For Bituminous Surfaces

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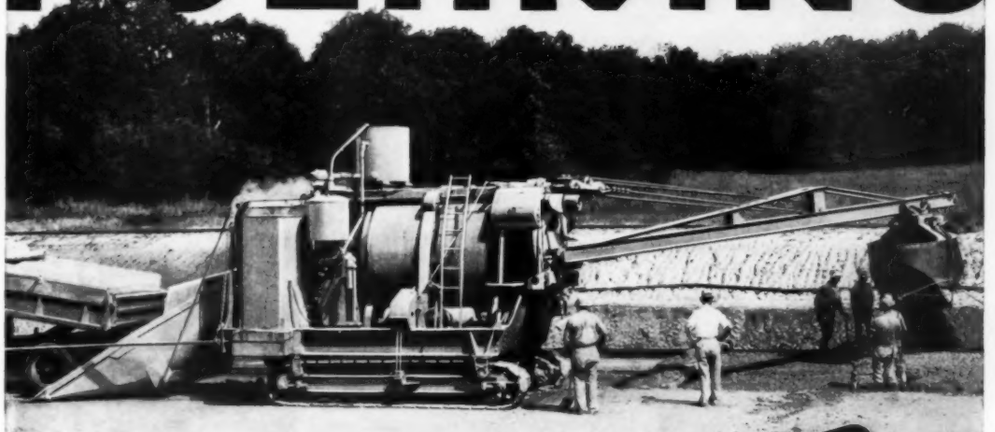
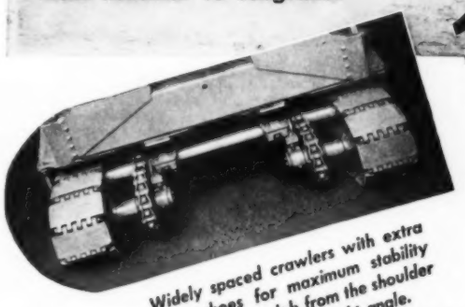
KOEHRING



Koehring 34-E Twinbatch Paver pouring highway slab from shoulder to subgrade.

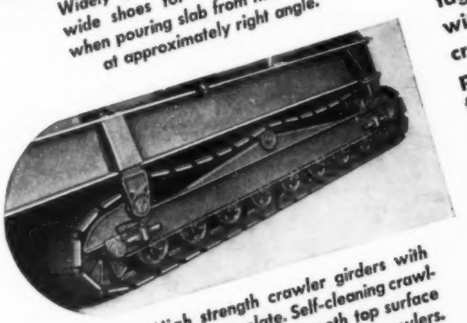
non-TIP POURING



Widely spaced crawlers with extra wide shoes for maximum stability when pouring slab from the shoulder at approximately right angle.

Koehring Paver maximum stability assures "non-tip" pouring from shoulder to slab, at approximately right angle. Widely spaced crawlers are advantageous for traveling on the shoulder with stability security. Extra wide crawler shoes provide low ground pressure. Crawler girders are reinforced with a heavy truss plate. A series of double faced guide rollers distribute the load equally over the length of the crawler frame. The Koehring Paver crawler assembly has strength, provides stability and low ground pressure for pouring from subgrade or shoulder to the slab.

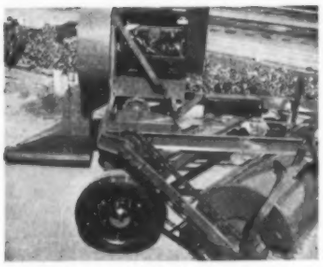
KOEHRING COMPANY
MILWAUKEE, WISCONSIN



High strength crawler girders with heavy truss plate. Self-cleaning crawler tumblers and smooth top surface shoes assure non-clogging crawlers.

KOEHRING HEAVY DUTY

HEAVY-DUTY CONSTRUCTION EQUIPMENT



The New Grace Highway Blower

New Road Blower For Highway Work

The new Grace blower, designed for removing loose dust and fines from the road surface before asphalt treatment, is a simple compact unit that may be used on a truck or on the standard Grace rear-axle-driven sweeper. A high pressure blast of air is produced in sufficient volume to remove completely any loose fine material in the path being swept.

The blower has a six-blade impeller 27 inches in diameter, with a housing 36 inches in diameter. The air is discharged directly toward the nozzle with no right-angle bends. A standard industrial power unit equipped with magneto, heavy-duty oil bath, air cleaner, standard Twin Disc clutch and power take-off, is direct-connected to the blower. No special bearings, shafts or clutches are used, and the standard power unit is quickly available for other uses if desired, it being necessary only to remove the impeller and the four bolts which hold the motor to the blower skid frame.

Literature describing this new Grace road blower may be secured direct from the W. E. Grace Mfg. Co., 1819 Chestnut St., Dallas, Texas, or from this magazine.

Concrete Paving Equipment

The line of concrete paving equipment, including straight-edges and lutes, pull brooms for broom-finishing concrete pavements, float bridges, longitudinal floats, concrete strike-offs, push planers, trail graders, and subgrade scrapers, made by the Cleveland Formgrader Co., 6725 Denison Ave., Cleveland, Ohio, is described in new literature recently issued by that company.

Interested contractors and highway engineers may secure copies of these new bulletins on any or all of this Cleveland concrete paving equipment by writing direct to the manufacturer.

New Chain Belt Dealer

The Harrod Equipment Co., Thompson Road & James St., Syracuse, N.Y., has recently been appointed exclusive distributor for the complete line of Rex construction equipment in the Syracuse territory, according to a recent announcement by the Chain Belt Co., Milwaukee, Wis., manufacturer of Rex concrete mixers, pavers, Moto-Mixers, cold-patch mixers, pumps and Pumpcrete.

Cotton Curing Mats Tested on Texas Roads

(*Continued from page 22*)

the District 15 warehouse in San Antonio.

Beginning on December 4, 1934, six of the seven test mats were used again on three concrete paving projects in Bexar County, along with the contractor's own cotton mats. On these three projects the test mats were used 10 times, making a grand total of 58 times the mats were used. On each of these 58 placements on the pavement, the mats were kept saturated with water for a minimum of 72 hours. The test mats were kept together at all times on each of the projects, and were saturated with water for a total of 355 days.

Life of Cotton Mats

The paramount object of these experiments with the seven test mats was to determine the number of square yards of concrete pavement a mat would cure before wearing out. All but one of the mats were of sufficient length (22 feet) to hang over the edges of the slab for protecting the edges, and the ends of the mats rested on the shoulder soil. On the Gonzales County project, it was found that the ends of the mats rotted where they rested on the shoulder soil, while the one 20-foot mat which covered only the top of the slab showed no rotting.

The wet mats were placed on the pavement by a man at each corner lifting the mat. The mats were not cleaned until after they had been used the 58 times, and consequently contained a great deal of dirt and cement. The strain when holding them up by each corner caused some of the 22-foot mats to start tearing while being used on the Gonzales project. The 20-foot mat was in good condition after being used 58 times and could have been used for an estimated 15 or 20 more placements, or an approximate total of 75 times.

Comparative Costs of Curing

Although careful cost data was kept by the Resident Engineer on the Gonzales County project, the costs are not exactly representative of those prevailing if only one method had been used exclusively instead of the ten methods. The 845 linear feet cured with the seven test mats cost 3.4 cents per square yard of pavement. The 4,393 linear feet cured with the wet-burlap wet-earth method cost 4 cents per square yard. This great difference in the amounts of linear feet cured threw a handicap on the cotton-mat cost per square yard. Also a 50-placement life of the cotton mats was used in figuring the 3.4-cent cost.

On the 11.644-mile Bexar County project, where cotton mats were used exclusively, the cost of curing averaged 3 cents per square yard, using 50 placements as the life of the cotton mats and the first cost of the mat was $6.00.

In September, 1936, the Texas State Highway Department received 19,872 cotton mats from the U. S. Department of Agriculture for experimental purposes in determining the average number of times a mat could be used before wearing out, and the cost of curing per square yard of pavement. Although the mats are generally still in good condition, a preliminary report was made on December 3, 1938, by the Construction Division. The government mats had been used to cure 221.512 miles, or 2,453,820 square yards of pavement.

The maximum average number of times these mats had been used was 35.2, and the maximum cost per square yard of pavement cured with the mats was 3.17 cents. The minimum was 1.51 cents and the average 2.422 cents. The first cost of the mats is not included in these figures, but would add approximately 1 cent to the cost per square yard of pavement cured, figured at 50 placements as the average life and $6.00 as the first cost of each mat. Based on this first cost, the total cost per square yard of pavement cured with the government mats was 4.17 cents maximum, 2.51 cents minimum, and 3.422 cents average for 203,384 miles or 2,238,617 square yards of concrete pavement cured with cotton mats.

This article is taken from a more detailed and comprehensive article by H. C. Porter which appeared in the March 15, 1939, issue of *Information Exchange* published by the Texas Highway Department.

October first is the last day on which nominations for the 1939 Roadside Development Awards may be mailed and still be eligible. Be sure yours are mailed in time.

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ROAD MATS
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CONTRACTORS' SUPPLY DEALERS in every state sell the Fulton line. Specify SHURE-DRY and FULTEX Tents, Tarpaulins, and Windbreaks—anything made of canvas. Also Fulco Road Mats and Burlap. Fulton products are good and their prices are right.

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See why this year and every year Rex is the buy! Send for new 1939 book, "Pay Less for Pumping." Address Chain Belt Company, 1679 W. Bruce Street, Milwaukee, Wisconsin.

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This small grapple, embodying the same revolutionary features of the large units, has been especially designed for truckcrane operation to make its exceptional efficiency available over wider areas. A combination grapple and orange-peel bucket is also available. Write for information.

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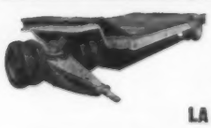

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Avoid Legal Pitfalls

These brief abstracts of court decisions may aid you. Local ordinances or state laws may alter conditions in your community. If in doubt consult your own attorney.

Edited by A. L. H. STREET, Attorney-at-Law.

Effect of an Illegality In Construction Contract

Sometimes an illegality is like a bit of limburger cheese, contaminating the entire substance in which it is contained. At other times, it is merely like a decayed spot in an apple that can be cut out without impairing the rest.

A highway contractor on a Federal-Aid project agreed with a subcontractor to take over unfinished clearing and grubbing, paying the subcontractor for what he had paid out for labor, etc. Later the contractor denied liability to reimburse the subcontractor for any part of his labor bills, on the ground that they included illegal overtime payments.

The Mississippi Supreme Court decided (Charles Weaver & Co. v. Phares, 188 So. 570) that the subcontractor was entitled to collect all the legal items of his bill, but not the items involving illegal expenditures. In short, the contract for taking over the job was itself perfectly legal, and the illegal payments being separable from the legal ones, there was no reason in good morals or law why the subcontractor should not be reimbursed as to them. But if the contract itself had had an illegal object, then it would have been void and no suit could have been based upon it.

Delayed Rights-of-Way

If a state highway commission had promptly furnished to a road contractor all the rights-of-way needed for a job, the work would have been completed by August 18. But delays in furnishing some of the rights-of-way deferred completion until December 11. The contract required that the contractor maintain the work in first-class condition until completion and for 30 days thereafter. This meant that, for the parts of the job that were promptly completed because rights-of-way had been furnished in due time, the contractor was put to nearly four months' extra maintenance cost. The Commission denied his right to reimbursement for this extra expense, but the Mississippi Supreme Court decided in favor of the contractor, saying (Wunderlich v. State Highway Commission, 184 So. 456):

"The Commission admits that it may be sued for its breach of contract if it failed to respond to its obligation by payment under some of the provisions of the contract, but denies liability to suit for its failure to respond as to breaches by it of other material parts of the contract, although occurring during the course of the same piece of work. To this contention, as thus stated, we cannot give our assent as being a correct interpretation of the law."

Comparing private and public construction contracts, the court notes that it was once aptly remarked by the New York Court of Appeals that when a state enters into a contract "it must be governed by the same rules of common honesty and justice which bind individuals".

Zoning Officials Jump Track

"Mr. Contractor, you can maintain your office and garage in this district of Los Angeles, because our zoning ordinance permits the carrying on a general contracting business in the district, but you must park your machinery and equipment somewhere else. It would mar the beauty of Southern California to permit you to keep trucks and other equipment on the lot back of your building, even if the lot is enclosed by an 8-foot fence." That is about what the city planning commissioners of L. A. said to a local contractor. Nor were the commissioners moved from their position when reminded that the ordinance expressly provided that "There may be the usual accessories in connection with such buildings, structures and/or uses," and that the ordinance explicitly permitted businesses properly located in the district to be conducted "as ordinarily conducted."

Nor were the commissioners convinced of their error when a superior court judge told them they were wrong. They appealed to the California District Court of Appeal, but without success for that tribunal said: "To hold that the plaintiff cannot store on his property the accessories necessary or usual to his business would be as unreasonable as to say that retail and wholesale houses cannot store on their premises the goods, wares, and merchandise which is their stock in trade or the equipment, machinery, and accessories ordinarily used in handling the same." (Greenfield v. Board of City Planning Commissioners of Los Angeles, 45 Pac. 2d, 219.)

Association Rule Held Void

"I promise that I'll not bid on any job in this county if any one outside the membership of this association is permitted to bid." That, in effect, is what a Kentucky contractor said when he joined a local association of contractors. But he took a contract, for which non-members competed. The association slapped a $500 fine upon him, and sued him for the amount when he refused to pay.

The Kentucky Court of Appeals approved the contractor's defense that the rule of the association barring its members from competing with outsiders was illegal and void as tending unduly to restrain competition for construction jobs. So the court relieved him from liability to pay the fine. (Jackson v. Sullivan, 124 S. W. 2d, 1019.)

The Court of Appeals recognized that each member of the association "had a perfect legal right not to bid on any contract, to withdraw a bid made on any contract and to confine his bids to such projects as he desired." But the court finds that it is something different when the members of an association representing a dominant influence in a local contracting field seek to bar bids by members unless all the other bidders are members too. "A combination of this kind," concludes the opinion, "has hurtful powers and influences not possessed by the individual, restrains trade, restricts and tends to destroy competition and seeks the advancement of the association at the risk of injury to the general public."

Definition of Terms

When a public contractor has given a statutory bond to pay for "material" used on a job, there is usually little ground for dispute concerning the coverage in favor of material men. On the other hand, there is no "nail" on which the seller of construction "equipment" to the contractor can hang a claim that the bond covers the price due, especially where the equipment is of such nature as to be usable on successive jobs—for example, tractors, excavating machinery, etc. But many a judicial headache arises in drawing the line between "equipment," not covered by a bond, and "supplies" that are covered.

The Washington Supreme Court was lately called upon to wrestle with the question whether detachable bits furnished to a road contractor for use in drilling through rock constituted "supplies" within the meaning of a contractor's bond, or "equipment." It was decided (United States & Fidelity Guaranty Co. v. Feenaughty Machinery Co., 85 Pac. 2d, 1085) that the bits were "supplies," and therefore covered by the bond, because they were worn out on a single job. The court recognizes that anything that is consumed or worn out on a single job is to be regarded as going into the job itself, essentially the same as construction materials.

For like reasons, the court decided that a bond to pay for "supplies" furnished a contractor covered the rental of machinery hired by him for use on the particular job. This rests on the theory that "the *use* of the machinery as distinguished from the machinery itself was consumed in the performance of the contract."

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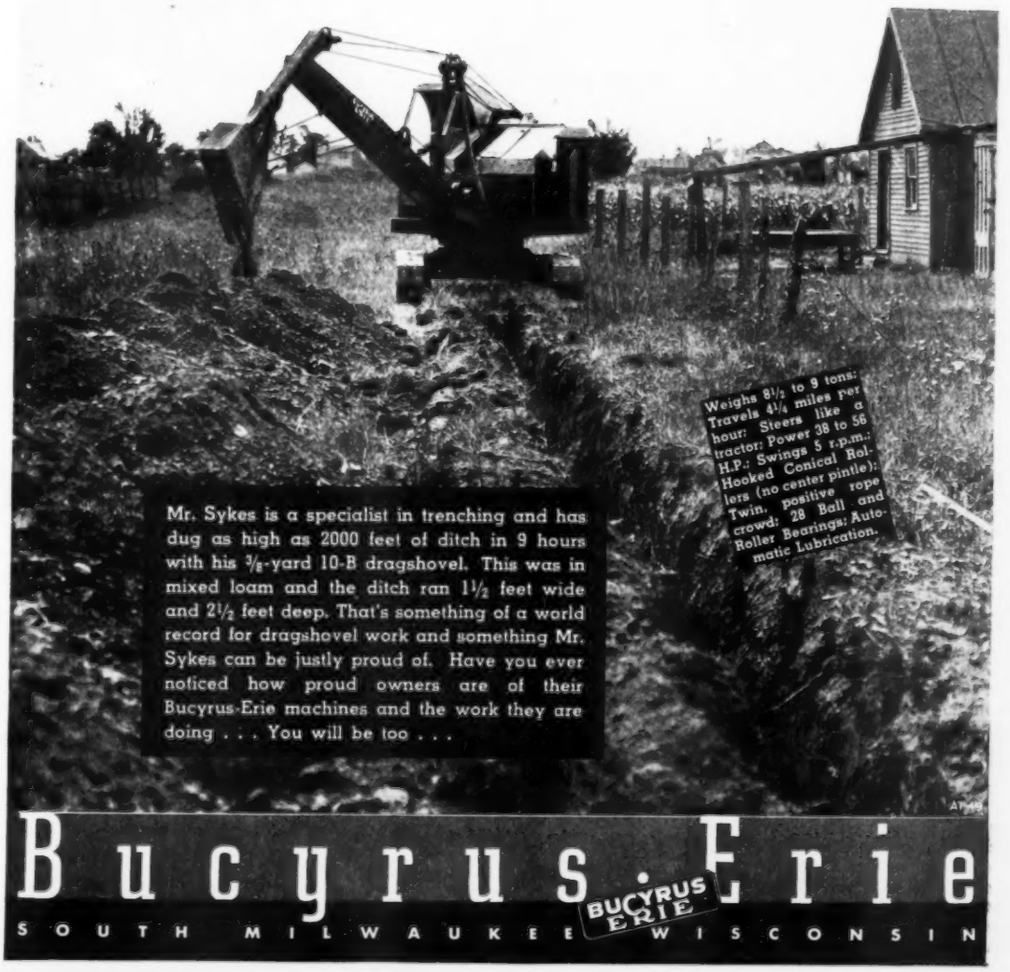
Weighs 8½ to 9 tons; Travels 4¼ miles per hour; Steers like a tractor; Power 38 to 56 H.P.; Swings 5 r.p.m.; Hooked Conical Rollers (no center pintle); Twin, positive rope crowd; 28 Ball and Roller Bearings; Automatic Lubrication.

Mr. Sykes is a specialist in trenching and has dug as high as 2000 feet of ditch in 9 hours with his ⅜-yard 10-B dragshovel. This was in mixed loam and the ditch ran 1½ feet wide and 2½ feet deep. That's something of a world record for dragshovel work and something Mr. Sykes can be justly proud of. Have you ever noticed how proud owners are of their Bucyrus-Erie machines and the work they are doing . . . You will be too . . .

Bucyrus-Erie

BUCYRUS ERIE

SOUTH MILWAUKEE WISCONSIN

Rebuilding Road Base For Black-Top Surface

(*Continued from page 11*)

come the subgrade troubles caused by capillary water or free water too close to the surface. Whenever this is done, the cross-section design should be such that all water rising to the bottom of the new fill will have a chance to run out to the ditches through the porous material. This means that the porous material must extend all the way to the side drainage ditches.

General Design

One of the first things to determine is whether or not the old grade line is to be maintained or a new grade line adopted. Information on the alignment, sight distances, the amount of gravel on the old road, and the necessity of placing new fill material to overcome unstable bases must be considered. As a rule, it is advisable to bring the design of the road up to date as much as possible by correcting bad alignment, obtaining satisfactory sight distances, and by improving the grade and drainage generally. Probably the most satisfactory procedure is to rebuild and widen to the old grade line wherever there is sufficient length of satisfactory road to make it practical and to adopt new grade lines only over those stretches where corrections should be made. The width of grade may vary considerably, but as a safety measure, it would seem that the earth shoulders should be at least 4 feet wide with greater widths where construction is not too expensive.

All gravel surfaces should be constructed at least 1 foot wider than the black top to be placed, to provide better support for the edges of the surface and also to furnish more leeway in carrying out the black-top operations. We use an 11-foot gravel base for a 10-foot top, a 19-foot base for an 18-foot top, or a 21-foot base for a 20-foot top. This latter type predominates but on all new construction of side roads which will have light traffic, we are building 11-foot gravel surfaces on 24-foot grades. While the black top will not be placed on many of these roads at the present time, the base is being constructed with the idea that 10-foot tops will be placed sometime in the future.

Reconstruction of Old Gravel

The thickness of the gravel surfaces should vary with subgrade conditions. On good or fair soils it is usually satisfactory to build a compacted depth of gravel of 6 inches; on poorer soil conditions, it is a safer practice to make the gravel 8 inches thick or even 10 and 12 inches thick in places which have caused trouble in the past.

When rebuilding and widening an old gravel road without changing the grade line, it is necessary to trench out the edges where there is little or no gravel. This should start at the edge of the future gravel surface and be carried toward the center of the road until a 3 or 4-inch depth of gravel has been found. The bottom of the trench should be at the same elevation as the bottom of the existing gravel surface. These trenches should be filled with gravel and enough additional gravel placed over the entire surface to obtain the thickness of gravel which the design calls for.

Bleeders for Drainage

In the complete reconstruction of an old road, the procedure is the same as on any new gravel road construction. A trench of the proper width and depth should be constructed and this trench filled with gravel and properly compacted. Wherever the shoulders are constructed of impervious material, stone or gravel bleeders should be constructed in the shoulders so that any water accumulating at the bottom of the gravel will have a chance to get out to the ditches. It is usually satisfactory to place these bleeders about 100 feet apart on each side of the road and stagger the locations so that there will be a bleeder approximately every 50 linear feet of road.

Types of Gravel Surfaces

Inasmuch as low-cost black-top surfaces must be placed on solid well-compacted bases, it follows that some type of gravel surface must be used which can be stabilized within a reasonable length of time. In recent years considerable use has been made of the so-called stabilized road which uses a high clay and silt content combined with water to make a mushy or muddy type of mixture. This requires very little compaction to obtain a dense and more or less rigid surface course. To construct a satisfactory surface of this type, it is necessary to proportion and mix the materials in a rather expensive plant, thereby adding to the cost. Also this type of road is not especially good as a wearing surface but should be followed up by the application of surface treatments or other types of black-top surfaces. The high clay content produces a very tight surface which is not sufficiently porous to take a satisfactory bituminous prime coat as the prime tends to stay on top of the surface and is not tied down by penetration into the gravel mixture. This type of surface usually contains about 12 to 15 per cent clay.

Stabilized gravel surfaces may be constructed with a clay content as low as 4 to 5 per cent, with the lack of clay and water in the mixture being replaced by compactive effort. This type of surface can be constructed from materials which are much less expensive and with less mechanical processing than the so-called clay stabilized gravel mentioned above. Most gravel deposits when combined with the proper quantity of cover earth or soil can be stabilized satisfactorily by tamper rollers. The following specification for this type of mixture is satisfactory as a base for a bituminous top, provided the top will be placed within a year after the base is constructed:

Passing 1½-inch square opening	100 per cent
Passing ¾-inch square opening	50 to 85 per cent
Passing 10-mesh sieve	20 to 40 per cent
Clay and silt content	5 to 12 per cent

By allowing the proper amount of cover material to break down with the bank, this mixture may be obtained from most gravel deposits without any screening or crushing other than that of removing the oversize stone which will not pass a 1½-inch screen. A good way to handle this material is with a power shovel, dropping the material through a flat screen into the truck body. Before loading the material into the trucks, it is advisable to mix the bank material somewhat with the shovel bucket.

As soon as the gravel has been placed on the road to make the proper width and thickness of surface, compaction should be started by hauling tamper rollers back and forth over the road. We have found the Beach roller very satisfactory for this work. A 2 or 3-ton pneumatic-tired tractor hauling two of these rollers behind it will consolidate this gravel and soil mixture about as fast as it can be hauled and placed. Some type of long base float should be operated on the surface at the same time to eliminate waves and other unevenness in the surface.

During long periods of dry weather, it is somewhat difficult to compact these surfaces because of the loss of moisture after the gravel has been placed on the road. If there is no rain for long periods of time, it is sometimes necessary to sprinkle the road with water during the packing period.

The bank-gravel type of surface is not

(*Concluded on next page*)

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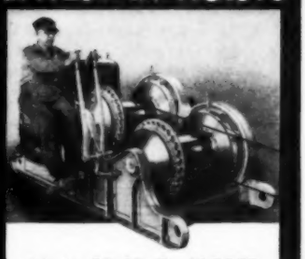

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MILWAUKEE, WISCONSIN THE HEIL CO. HILLSIDE, NEW JERSEY

Low-Cost Road Work In Kent County, Mich.

(*Continued from preceding page*)

satisfactory as a wearing surface because of the presence of a considerable quantity of material above ¾-inch in size. Under any conditions, it is usually necessary to rake the surface or in some way remove a little of the larger material which always finds its way to the surface and remains on top after the job is finished.

Gravel Wearing Surface

When it is necessary to maintain a gravel base for a year or more before the top can be placed, it is advisable to use a finer material for at least the top 2 inches. In the case of two-course work, it is good practice to use run-of-bank gravel for the base course and the finer type for the top course. This top-course material is satisfactory for the whole thickness but is more expensive. The specifications we are now using for this material are:

Passing 11/16-inch round or ⅝-inch square opening	100 per cent
Passing ⅜-inch round opening	65-80 per cent
Passing 10-mesh sieve	25-50 per cent
Crushed material (⅜ to ¼-inch)	30 per cent (min.)
Clay and silt content	4-10 per cent

This top-course gravel when properly screened and crushed and including the purchase price in the bank usually costs about 50 to 60 cents per cubic yard while the bank-run gravel costs about 10 cents per cubic yard in the bank and about 20 cents mixed and loaded into trucks. It is therefore obvious that considerable saving may be effected by using as much of the bank-run material as possible.

It is, of course, necessary that any gravel surface must be properly maintained from the time it is built until the black top is placed, as the smoothness of the black top is to a large extent dependent upon the smoothness of the base.

All of the 125 miles of black-top surfaces in Kent County were placed on gravel bases similar to those described above. About 65 per cent of the mileage has been a drag surface treatment type about ½ to ¾ inch in thickness; the balance has been 1½ and 3-inch mixed-in-place retreads, with a relatively small mileage of 3-inch thickness. At the present time, practically none of our retreads are being built more than 1½ inches thick. Where base conditions are difficult it has been found more economical to spend more money on the base rather than to attempt to correct base weaknesses by building thicker tops. The annual maintenance cost on these black tops is relatively low and we have had no failures other than occasional small patches. We have, therefore, concluded that this type of base construction meets our local conditions and we believe that the methods outlined above can be used anywhere that generally similar conditions exist.

From a paper presented before the Twenty-Fifth Annual Highway Conference at the University of Michigan in February, 1939.

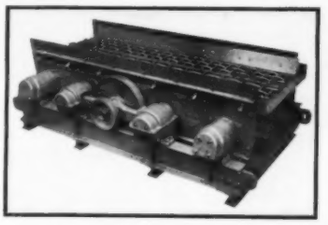
New Mud-Jack Catalog

A new 12-page catalog on the Koehring Mud-Jack and the Mud-Jack method has recently been issued by the Koehring Co., 3026 W. Concordia Ave., Milwaukee, Wis. Both Mud-Jack models have recently been redesigned and the latest models are described and illustrated. Other photographs show the construction and method of application while line drawings suggest the proper procedure for drilling the holes in concrete slab. The wide application of this equipment is illustrated by still other photographs.

Copies of this new catalog may be secured by state and county highway engineers and by interested contractors direct from the manufacturer.

High-Speed Vibrating Low-Angle Rock Screen

High-speed vibrating screens with a full floating eccentric shaft and low-angle screening are described in Bulletin 749 issued by The W. S. Tyler Co., 3615 Superior Ave., N.E., Cleveland, Ohio. The Ty-Rock screen is made as either a single, double or triple-deck unit. The action of the Ty-Rock is particularly suitable for coarse and medium sizes of material. Even when handling high tonnages of material the Ty-Rock screen is reported by the manufacturer to produce no reaction in the base frame or the supporting framework of the screen. This is due to the fact that the shaft is carried on arms supported by live rubber mountings which absorb the shocks which are destructive both to bearings and to the supporting framework. The rubber mountings allow the shaft to revolve freely around its own natural center of rotation and therefore prevent any vibration whatever escaping from the screen.



A Tyrock Vibrating Screen

The circle-throw gyratory action of the Ty-Rock screen opens up a heavy bed of coarse material, turning the oversize pieces over and over and bringing the fines to the openings in the shortest possible time. Thus the fines are removed more thoroughly, and larger capacity is combined with greater accuracy of sizing at a low cost per ton.

The well-known Tyler-Niagara screen is described and illustrated in Catalog 750, which may be secured with the bulletin mentioned above by writing direct to the manufacturer or through Contractors and Engineers Monthly.

Earth-Moving Equipment In Highway Construction

Reprints of a talk "Tools and Equipment for Earth Moving in Highway Construction" given by Frank A. Nikirk of the Caterpillar Tractor Co. before the Twelfth National Asphalt Conference in Los Angeles have recently been made available by Caterpillar. This discussion, which points out that highway construction today requires moving six times as much earth per mile as was required prior to 1919, covers the development of the various types of earth-moving equipment and discusses the latest machinery and what it will do. Illustrations of the equipment are included in the reprints.

Contractors and state and county highway engineers will no doubt find much of interest and help in this discussion and may secure copies from the Caterpillar Tractor Co., Peoria, Ill.

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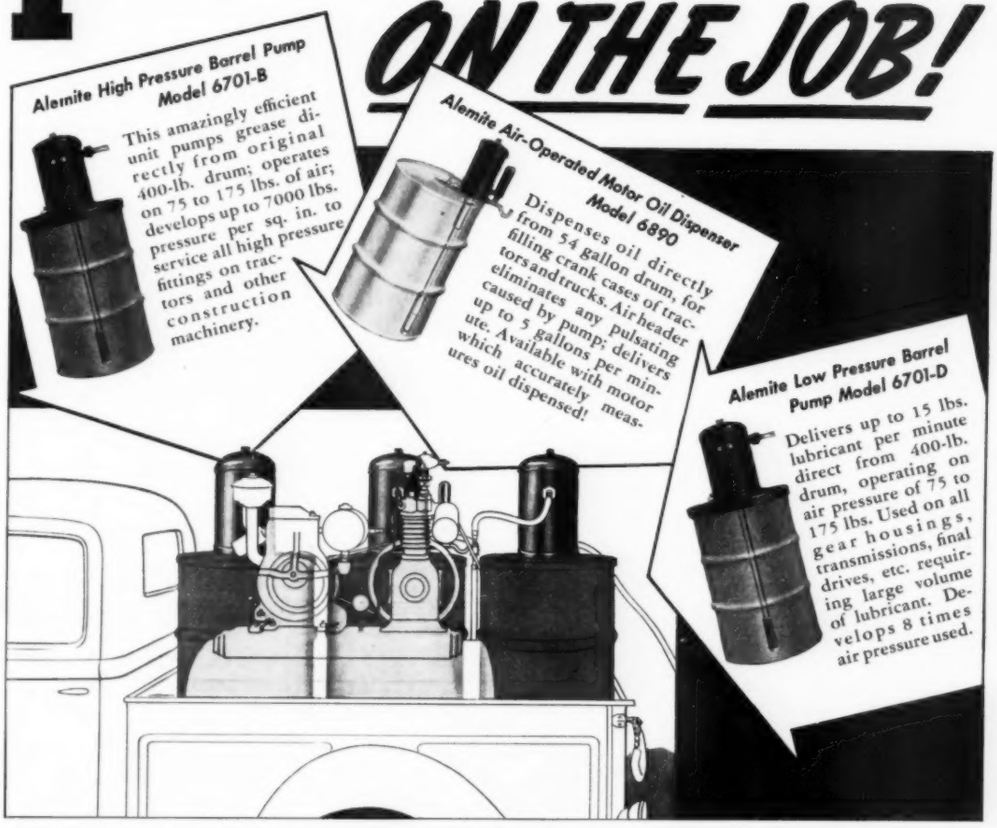
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This amazingly efficient unit pumps grease directly from original 400-lb. drum; operates on 75 to 175 lbs. of air; develops up to 7000 lbs. pressure per sq. in. to service all high pressure fittings on tractors and other construction machinery.
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Steam Dredge Used On River Levee Job

(Continued from page 16)

ler is 16 inches. The pump has a 28-inch discharge and a 34-inch suction. The pump casing is so designed that it may be used without greatly varying efficiency with impellers having from two to five vanes and from 80 to 90 inches in diameter.

The pump casing has one manhole at the top and one on the suction line just ahead of the throat of the pump. When the vanes are jammed with logs the manholes are opened and the logs pulled out with Beebe hand winches. Logs as long as 4 feet and up to 2 feet in diameter have been removed quite easily at times; other times it was very difficult.

The actual pump suction is measured on the dredge with a column of mercury instead of the usual gage and the suction runs up to 28 inches under operating conditions while the maximum pressure developed on the discharge line for long distance pumping is 125 pounds per square inch.

The Auxiliary Diesel Engine

A 6-cylinder Worthington diesel engine developing 150 hp is installed to drive an Electro Dynamic Co. 100-kw generator at 514 rpm, 250 volts and 400 amperes. The generator is direct connected to the engine and has compound winding. This unit is used to supply electric current to the entire dredge for various services in case the steam plant is down for repairs or cleaning.

Cutter Motor and Winches

A 750-hp Allis-Chalmers motor drives the cutter through two reduction gear units cutting the speed from 600 at the motor to 21 rpm at the cutter head. The motor requires 2,400 amperes at 230 volts. The cutter shaft is driven through an upper and a lower universal at either end of a square telescopic shaft. The hauling motor for the lines is a 65-hp motor driving through a 15 to 1 gear ratio to the bull shaft and the winches. There are two winches aft in the group for the spud hoists and two side center winches for the swing anchor hoists, with two additional at the side and forward in the group for swinging. The center forward winch is used for raising the ladder. This grouping of all the winches forward of the center of the dredge makes for operating convenience and efficiency.

The stern anchor winch is located on the starboard deck forward and is driven by the bull shaft of the main hauling gear assembly. It carries a 1¼-inch cable with a steel center, which is 3,580 feet in length. There are two 10,000-pound single fluke anchors for holding the dredge on the end of the stern wire. The cable runs out through a flat 18-inch sheave on the starboard stern, then out over a sheave to carry it over the top of the deck next to the port spud. This takes a load off the working spud when operating in the usual 5½-mile current. The cable is further guided by a swivel sheave which holds the cable down to clear the pontoon line.

Auxiliary Pumps

There is a wide variety of auxiliary pumps on the dredge to care for the many services required. These include a pump for boiler make-up water, a regular boiler feed pump, and two bilge pumps, all located in the lower hull. Then there is a pump for handling the condensed steam from the condenser back to the boiler feed-water tank, three additional bilge pumps, these on the opposite side from those mentioned before, and a steam-driven fire pump. These pumps are all packed away where they can be started quickly but where they are not in the way of the normal operation of the working parts of the dredge.

Pneumatic Controls

Three Worthington single-cylinder air compressors are tucked away under one of the walkways on the starboard side of the hull within the main operating section and are electric driven to furnish air for the Page pneumatic controls used by the dredge operator for handling all the functions of the dredge. The compressors operate automatically either singly, in multiple and in rotation as required to maintain 120 pounds pressure for the operation of the controls.

The Spuds

The pair of spuds for the "G. A." are 110 feet long, 31 inches square and built of 1¼-inch steel hollow and watertight. They weigh 35 tons each. They are contained externally at the stern by two keepers each, which are 12 feet apart vertically and the spuds are 26 feet 6 inches apart center to center. The spuds are hoisted by block and tackle suspended from a gantry frame at the extreme stern of the dredge. A Beebe hand winch is used for changing the position of the hitches. A heavy pin is used to hold the spuds at a given elevation while the hoist and the hitches are set for another raise.

The Pipe Line

The dredge G. A. McWilliams on this particular assignment carried a maximum of 2,000 feet of floating line, 6,000 feet of shore pipe and, on another project, has pumped a total distance of 16,000 feet with a 45-foot lift including the land line. The connection between the discharge from the dredge and the floating line is a triple ball joint permitting complete freedom of movement of the dredge without placing any strain on the pontoon line. The pontoons consist of two or three floats for each 50-foot section of pipe. The connection between the floating line and the land line is a single ball joint with the pipe suspended from the last pontoon section by an A frame to care for the rise and fall of the river. The ball joints used on this line are made by the Mobile Pulley & Machine Co., Mobile, Ala. The floating as well as the land line is made up of Armco spiral welded pipe.

The shore pipe is 28 inches in diameter and in 16-foot lengths which make up 15½ feet in the line because of the slip joints. The lengths are clamped on each side at each end with a chain and wedge connection that is very efficient and easy to make and break. The shore pipe is 3/16 inch thick and the pontoon ½-inch thick when new. A Y connection in the line with two sluice gates permits the material to be delivered to a waste line while the active section is being extended, thus obviating the need for shutting down the pump when making the line change. The sluice gates are equipped with double rollers so that they may be readily moved along the line when needed. Anyone who has walked a dredge line, pontoon or land line, knows that it is difficult enough to maintain one's balance without wrestling with a sluice gate. The men move one of these heavy gates with remarkably great facility over the top of the pipe line due to the rollers.

Work at Glasscock Cut-Off

The work at Glasscock Cut-off on the Mississippi River about 18 miles below Natchez, Miss., consisted of cutting the banks which do not wash out readily, causing further and increased erosion by exposing freshly cut bank to action of current. The dredge was rented by the U.S. Engineer Department for this work on a production basis. With a land line of nearly one mile of pipe, the material was wasted on an island. The production was very high during the entire work with from 11 to 18 per cent solids being delivered through the discharge line.

The discharge velocity varied from 20 feet per second with a good load of clay or other heavy material to 25 feet per second with water alone, according to measurements of the engineers of the U.S.E.D. The discharge of solids varied from 1,000 to 1,600 cubic yards of material per hour, depending on the bank ahead of the dredge. Measurements of the solids delivered is always made by soundings of the dredged section.

Personnel

An item of unusual interest on the dredge is the installation of a short wave radio for the use of the Inspector so that he may keep in touch at regular intervals with the base stations of the U.S.E.D. at Natchez and New Orleans. Were it not for this equipment, communication with the dredge would be completely lacking except when a boat is used to make the trip to the nearest telephone. This would require about as much time as to buck the current of the River the 18 miles back upstream to Natchez.

The G. A. McWilliams is manned by a crew of 108 men operating on three 8-hour shifts. The dredge, owned by the McWilliams Dredging Co. of New Orleans, is in charge of L. C. Gibbs as Captain. C. S. White, Junior Engineer, was Inspector for the Dredging Division, Second New Orleans Engineer District.

The importance of proper lubrication can not be stressed too often or too emphatically. If you have any special lubrication or maintenance problem, write the Editor.

For Sale or Trade

2—18-20-yd. LeTourneau Carry-all Scrapers, excellent condition. With or without Caterpillar RD8 Tractors. Or will trade for smaller tractors and scrapers.

CHADWICK MACHINERY CO.
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AMERICAN
GENERAL PURPOSE HOIST

Ready and Able for Every Job

SPEED and hair-line accuracy for material elevator work; sustained power; sturdiness in every part for haulage and car puller service; speed and ease of handling — give this great hoist an important "edge" for pile driving work. Supreme in the 20 to 100 H. P. field. A one drum hoist can be expanded in the field to three drums and slewer.

Write Dept. CE for Bulletin 100-H-1.

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Cranes Take Fast, Hefty Swings with a Williams Bucket on the Boom!

★A tricky fight manager once stuffed a lot of horseshoes into his fighter's gloves. But he overloaded them so the poor pug could barely lift his hands—and was an easy knockout. *Don't handicap your cranes the same way!*

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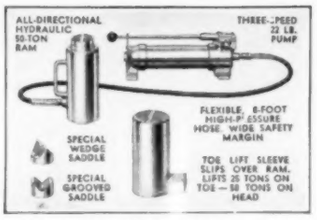
ALL-DIRECTIONAL HYDRAULIC 50-TON RAM
THREE-SPEED 22 LB. PUMP
FLEXIBLE, 6-FOOT HIGH-PRESSURE HOSE, WIDE SAFETY MARGIN
SPECIAL WEDGE SADDLE
SPECIAL GROOVED SADDLE
TOE LIFT SLEEVE SLIPS OVER RAM, LIFTS 25 TONS ON TOE—50 TONS ON HEAD

The Model S-80 Porto-Power Jack

50-Ton Power Jack Is All-Directional

The new 50-ton Model S-80 Porto-Power jack, recently announced by the Blackhawk Mfg. Co., Milwaukee, Wis., is capable of all-directional action because its pump is separated from the ram by a durable high-pressure hose. This remote-control feature also enables the jack to work in dangerous or cramped quarters.

Another feature is its light weight, the 22-pound pump and 60-pound ram being easily carried by one man. A selector valve on the pump regulates the pumping speed of the ram for 15, 25 or 50-ton loads. The ram, having a low height of 11 inches, has a 6-inch hydraulic lift and its plunger retracts automatically when the release valve on the pump is opened. The Model S-80 Porto-Power includes two special saddles for pushing against bars, grooves, etc. A sleeve is also available for converting the ram to a toe lift jack, lifting 25 tons from 2¼ inches off the ground to a height of 8¼ inches.

Complete information on this Port-Power jack and other jacks in the Blackhawk line may be secured by those interested direct from the manufacturer.

Roadside Improvement On Vermont Highways

During the past two years, the Vermont Department of Highways has spent the one per cent of its Federal-Aid highways funds to be devoted to roadside improvement with the aim of so improving the roadside that it becomes an integral part of the adjoining landscape. The important thing, as stated in the latest Department report, is the restoration of the roadsides to natural contours covered with grasses, shrubs, or trees that existed there before the highway was built. Well-sodded slopes, slopes protected by a vegetative cover, slopes well flattened, and cuts rounded back at the tops all tend to reduce maintenance costs as well as improve the appearance of the highway.

The Department has regraded, seeded and sodded many miles of cut slopes on projects which were built several years ago. In all cases the old slope had failed to become covered by Nature alone, and presented an unsightly, eroded surface requiring constant attention. Much of the roadside improvement work has been done by force-account labor, but a part has been included in the various contract projects and carried out at the same time the road was built.

A great deal of this work is also being done by regular patrol crews as a part of their maintenance operations. Among other things, rubbish bins and a few picnic tables have been placed at locations where motorists are in the habit of stopping. This service, however, is definitely limited by the priority of other maintenance requirements.

There is still much needed improvement along Vermont highways, the Department report states. There are a great many things such as old borrow pits, raw slopes, dumps, billboards, tumbled down buildings and other scars on the landscape, some of which are the responsibility of the property owners who live along the highway.

The best roadside improvement will always be that which shows Nature the least disturbed. The aim of this work in Vermont is to make that state's highways present a simplicity in keeping with Vermont's natural beauty.

Highway Safety

The encouraging reduction in highway fatalities last year has heartened and invigorated the nation-wide effort, continuing the battle for greater highway safety, according to the National Highway Users Conference.

Scores of bills dealing with drunken drivers were enacted into law, though most of them pertained to revisions of existing statutes. Maine now provides for an alcohol blood test. Speed limits were amended or established, though the majority of such bills leaned toward liberalizing existing laws by increasing the limit up to 50 or even 60 miles an hour for daylight driving.

Florida has enacted a comprehensive highway patrol law, thus providing for some type of patrol in every state.

Pneumatic wheel mounted 3 H. P. gasoline engine vibrator. Can also be used for SURFACING, PUMPING, SAWING, GRINDING and DRILLING.

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Faster, Better, Cheaper
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Get better bond with reinforcement—get denser and stronger concrete—eliminate aggregate pockets and expensive patching. A type and size for every job!
Send for circulars on the many gas engine, air and electric models, and let us advise you regarding the proper unit for greatest savings on your work.

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CONCRETE slows up when the thermometer goes down.

The time required to attain safe compressive strength in concreting at 40° is approximately double the time required at 70°. But standard portland cement mixes which took 14 days at 40° to attain safe compressive strength, required only 7 days under the same temperature, *when calcium chloride was used in-the-mix.* (From the National Bureau of Standards report of tests on the effect of calcium chloride on portland cement concretes.)

Many engineers and contractors have learned through 25 years of experience in the use of calcium chloride in concrete that the features so desirable in summer are a real necessity in cold weather if concrete placed at temperatures below 50° is to be satisfactory.

These features are:

1. Accelerated Rate of Hardening.
2. More than 100% gain in early (first day) strength.
3. From 29 to 41% increase in flow which fills forms better, adds density, improves waterproofness.
4. Greater ease of placing the more plastic mix.
5. Better finish, fewer voids, less troweling needed.
6. Earlier removal of forms, quicker placing of walls on foundations.

You cannot afford to place concrete in cold weather without knowing these advantages, proved beyond doubt in the world's best laboratories, as well as in the field. Write for literature.

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DON'T STEP ON A NAIL!

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And incidentally our High Tensile Clamps and Ties are the Best Safety Insurance. 100 lin. ft. cut & threaded, $3.00 for ⅜", $4.00 for ½". Quantity discount. Job lot price.

Williams Form Engineering Corp.
Box 925, Madison Square Sta.
Phone 33823 Grand Rapids, Mich.

Preparation of Aggregates Is Feature of Work at Dam

(*Continued from page 1*)

During construction, diversion of the river has been provided by the construction of two 26-foot conduits through the dam and extending upstream from the face of the low dam to the face of the proposed high dam. These will be closed by installing bulkhead gates and backfilling with concrete.

The contract for the construction of the low dam was awarded by the Secretary of the Interior on December 3, 1936, to Brown & Root, Inc., of Austin, Texas, and the McKenzie Construction Co. of San Antonio, Texas, for the low bid of $5,781,235. Work was started on January 14, 1937, with 900 working days allowed for completion of the contract. This was increased by subsequent change orders to 1,140 days.

Excavation of Aggregates

The borrow pits from which part of the raw aggregates for the concrete at Marshall Ford Dam was excavated extend for a distance of over 2 miles along the shores of the Colorado River of Texas about 2 miles upstream from the dam itself and a maximum haul of 1⅛ miles. The gravel was excavated from the pits with two Koehring 601 and one Osgood 1½-yard draglines with Page and Bucyrus-Erie buckets and loaded to nine pneumatic-tired 4-yard semi-trailers owned by the contractors and to twenty 2-yard dump trucks hired by the hour. The unusual semi-trailers were referred to as "jallopies" on the job, a good name for the powerful make-shift combination of stripped Ford trucks and home-grown metal bodies mounted on the trailers. The trailers were bottom-dump while the trucks were all end-dump.

Conveying the Aggregates

The hauling units dumped the loads into a hopper which they straddled and then drove off for more loads. The material was fed from the hopper to the first conveyor belt by a reciprocating feeder driven by a 7½-hp electric motor. The 30-inch belt 161 feet in length center to center of pulleys delivered the material at a speed of 600 feet per minute to an Allis-Chalmers scalping screen which removed all material over 6-inch size. The belt was driven by a 40-hp motor. The oversize material was delivered direct to an 18 x 36 Cedar Rapids jaw crusher and dropped directly onto another 30-inch belt 159 feet in length driven at 600 feet per minute by a 40-hp motor. This delivered the crushed material to the raw stockpile, which had a maximum storage of 6,500 cubic yards, over a concrete recovery tunnel 6 x 6½ feet and 200 feet long.

To get the aggregates from the storage pile to the processing plant required a reciprocating feeder in the recovery tunnel delivering the material to the 30-inch recovery belt 320 feet long and driven at 400 feet per minute by a 40-hp motor. Two transfer belts were required to get the material up the hill to the washing and screening plant. The first transfer belt was 30 inches wide, 175 feet long and driven at 300 feet per minute by a 40-hp motor. The second, the same width, was 257 feet long and driven at 500 feet per minute by a 50-hp motor.

The Washing Plant

At the top of the second transfer conveyor the materials were delivered to a 2-deck Allis-Chalmers vibrating screen which sized the material into 3 to 6-inch, and 1½ to 3-inch material. The material passing through the two decks was divided and delivered to two 2-deck low-head Allis-Chalmers vibrating screens measuring 4 x 12 feet which screened out ¾ to 1½-inch and No. 4 to ¾-inch material. The sand went through to the classifiers. Washing was effected by powerful streams of water at the top and on each deck of each screen delivered through Binks Spray Engineering Co. nozzles.

The sand went to a settling tank, which was somewhat small for the volume of material delivered to it, and then to the No. 1 Dorr classifier for the coarse sand. This classifier was 6 feet x 25 feet 6 inches in length and on a slope of 2½ inches per foot. The second classifier of the same type measured 8 feet wide and 21 feet 8 inches long and had the same slope. This No. 2 classifier took care of the fine sand. In the front of the first classifier, the discharge could be divided into eight parts. According to the various requirements, these were directed in varying numbers to: wasting by a flume to the river; the rod mill for grinding because of the scarcity of fine sand; the stockpile direct.

The Allis-Chalmers rod mill, measuring 5 x 10 feet, used 35,000 pounds of 4-inch rods and discharged to No. 2 classifier, increasing the volume of fine sand produced.

The various sizes of materials were delivered by stacker belts to stockpiles. There were two sand and four gravel stackers as follows: a 24-inch belt 178 feet long driven by a 5-hp motor for 6-inch stone; a 24-inch belt 115 feet long driven by a 5-hp motor for 3-inch stone; an 18-inch belt 95 feet long with a 5-hp motor for 1½-inch stone; another 18-inch belt 159 feet in length with a 5-hp motor for the No. 4 to ¾-inch material; a 24-inch belt 268 feet long with a 10-hp motor for moving the sand out to the 24-inch stacker belt 75 feet long driven by a 7½-hp motor. All of the storage piles of washed aggregate were over the 500-foot recovery tunnel, with a cross section of 6 x 6½ feet and with six gates for sand and two for each of the other sizes. All the gates were hand operated.

The 598-foot recovery belt for the washed material was 30 inches wide and delivered the washed material to a 5 x 14-foot Allis-Chalmers rotary washer for a final scrubbing. This was not used for the sand. Water for both the initial and the rewashing was furnished by an 8-inch Cameron pump delivering 2,500 gpm against a 250-foot head and driven by a 200-hp motor. The pump was mounted on a small barge in the river so that when the flashy stream rose the pump would not be inundated. The Superintendent of the aggregate plant reported that on one occasion he was awakened about 4 a.m. with a call that

(*Concluded on next page*)

C. & E. M. Photo

The Steel Aggregate Silos at the Delivery End of the Aerial Tramway at Marshall Ford Dam near Austin, Texas

SHUNK

D-K SPREADER

AND FINISHING MACHINE AND BITUMINOUS PAVER

- Lays any type mix, hot or cold
- Lays any thickness desired
- Levels without forms
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No high or low spots when re-surfacing with a D-K Spreader

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Aerial Tramway Used To Deliver Aggregate

(*Continued from preceding page*)

the stream was rising. The water was a few feet below the lower bridge over which the aggregate trucks had been hauling and before he could reach the upper bridge from the camp the water was over the top of the bridge. When he reached the site of the pump, a drive of about 3 miles in all, the pump was at midstream of the rising flood. Trash from above was flowing between the pump and the shore, making it very dangerous to attempt to get more lines out to the pump. It held and was not damaged.

Other incidental information of interest at the aggregate plant concerns the disposal of the large amount of surplus or waste sand which was flumed to the river. The floor of this flume was lined with concrete, to resist the abrasive action of the sand-laden water.

After passing the rewasher or scrubber the material was transferred to the bins in the tramway-loading terminal by a 30-inch belt conveyor 156 feet long, moving at a speed of 400 feet per minute and powered by a 40-hp General Electric motor. The aggregate plant, excavation equipment, the aerial tramway and the concreting plant erected for the production of concrete for the low dam represented an investment of about $1,000,000 by the contractors.

Aerial Tramway

An American Steel & Wire Co., aerial tramway with eighty-five 36-cubic foot buckets carried the finished aggregates from the plant overland and across the Colorado River to the aggregate bins adjacent to the concrete mixing plant close to the dam. The tramway had a capacity of 250 tons per hour and required only a single 100-hp electric motor to drive it. Compare the power that would be required to operate the equivalent capacity in motor truck hauling equipment—at least fifty 5-ton trucks without allowance for breakdowns and the much longer haul over the winding road between the two terminals. Except for a few minor adjustments that required shutting down the tramway when it was first erected, there were practically no time losses. Even lubrication was handled without stopping the service as one bucket was switched into the line carrying an oil tank. The tank was filled with the proper grade of oil for the track cable and a "shot" of compressed air which actuated a valve permitting the application of the oil in jets and thus kept the cable in A1 condition. The bucket was placed on the line three times a week for a round trip. The individual buckets ran on the 1⅝-inch outgoing and 1-inch incoming or unloaded track cable on four 10-inch track wheels which were lubricated regularly by running the bucket off onto a switch or spur at the loading station and greasing by hand.

The track cable rested loose on slightly arched channels over the twenty-five towers between the two terminals. Where the tramway jumped the river a 1¾-inch high-strength cable was used for the 1,500-foot span. The slack in the cables was taken up by counterweights suspended from tower No. 12. Each bucket was plainly numbered so that any trouble could be reported and the bucket easily identified on its return to the loading station and taken off for repair. The traction rope was a ¾-inch cable. An ammeter at the switchboard showed the power consumed, and if the consumption ran high it was an indication of trouble on the tramway and the motor was shut down immediately.

At the loading station there were two bins for sand and one for rock. Five men operated the system from the loading end and no other men were required. There was a turn-head man on top to regulate the filling of the bins, two bucket loaders, the operator, and the trip man who started the loaded buckets out onto the cable from the track at intervals of about 237 feet. The buckets were automatically latched to the cable as they left the loading plant and were not unlocked from the traction cable until they returned empty to the loading terminal when another automatic device threw the short latching arm up and released the bucket. It rode along the permanent track by momentum and a slight drop in the grade. At the far end where the aggregates were unloaded into the several steel silos the buckets were tripped automatically so that the bottom opened and the contents dropped into the proper silos. A telephone message to the bin operator told him the last bucket that contained a certain size of stone when he had indicated that enough had been received and the trip was set at another bin for the proper size.

Storage of Aggregates

As indicated above, the aggregates were stored adjacent to the concrete plant in steel tanks. These were old oil tanks equipped to feed below to a retrieving belt or through chutes in the sides to trucks for any miscellaneous purposes. The traction cable of the tramway ran around a 20-foot diameter bullwheel at the far end of the silos while the buckets were still attached to the cable. On this system no extra man was required at the unloading end to unlatch and relatch the buckets to the cable as is common in this general type of aerial tramways.

Personnel

The Marshall Ford Dam is being built by the U. S. Bureau of Reclamation for the Lower Colorado River Authority which will operate the dam after completion. The work is in charge of E. A. Moritz, Construction Engineer, with Charles P. Seger, Resident Engineer, both of the Bureau of Reclamation engineering staff. For the contractors, Brown & Root, Inc., and McKenzie Construction Co., the work was under the direction of Ross White, General Manager, with E. M. Whipple, General Superintendent, M. P. Anderson, Chief Engineer, and C. H. Gaut, General Foreman in charge of aggregate production.

New Self-Contained Diesel Electric Sets

Two new completely self-contained diesel electric sets, for providing electricity for pumps, lights, small tools, welders and similar uses, have just been announced by the Caterpillar Tractor Co., Peoria, Ill. These lightweight sets need no special bases but can be set down anywhere and put to work. Actual installation is so simple that the only wire connections to be made are from the generator terminal to a circuit breaker, and from the circuit breaker to the distribution box.

All electrical equipment required by the sets is inbuilt, with the exception of the circuit breaker. No rheostats, switchboards, or instruments of any sort are needed. Because sets of this capacity are almost always operated close to the power destination, even a voltage regulator is unnecessary, according to Caterpillar engineers. The engines have but three operating adjustments, none of which involves the diesel fuel system. The generators are of single unit construction, equipped with ball bearings which require lubrication only once in six months.

The two sizes available are the 34-15 and the 44-20. The former is supplied in three-phase 110, 220 or 440-volt models at 15 kw, and is also available as a single-phase 110/220-volt three-wire type and 110 and 220-volt two-wire type at 13 kw. The 44-20 set is supplied in three-phase 110, 220 or 440-volt models, at 20 kw. It is also available in the single-phase 110/220-volt three-wire type, and 110 and 220-volt two-wire type at 18.5 kw.

New Trench Hoe Is Easily Converted

The new P & H Model 255 trench hoe, recently announced by the Harnischfeger Corp., 4419 W. National Ave., Milwaukee, Wis., may be easily converted for use as a shovel, dragline, clamshell, crane, skimmer scoop or pile driver. It may be equipped with a bottom-dump bucket or with a solid-dump bucket. This trench hoe will dig to a maximum depth of 18 feet and the solid bucket will cut a trench with side cutters 34 to 38 inches wide, while the bottom-dump bucket will cut a trench 32 to 36 inches wide.

Combining rapid line speeds with ample power, this ¾-yard machine is equipped with tractor-type crawlers for fast easy travel. It has three forward speeds ranging from ⅝ to 2½ miles an hour. There is also a change of pace for digging, to meet every need in either easy or tough going. The Model 255 is equipped with a swivel-type hoe stick pivot bearing which is designed to absorb shocks by eliminating twists in the boom. It is built of all-welded alloy steels throughout.

Detailed information on the new P & H Model 255 trench hoe may be secured direct from the manufacturer or from this magazine.

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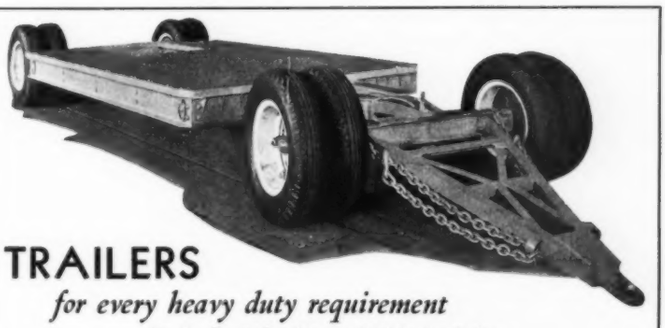

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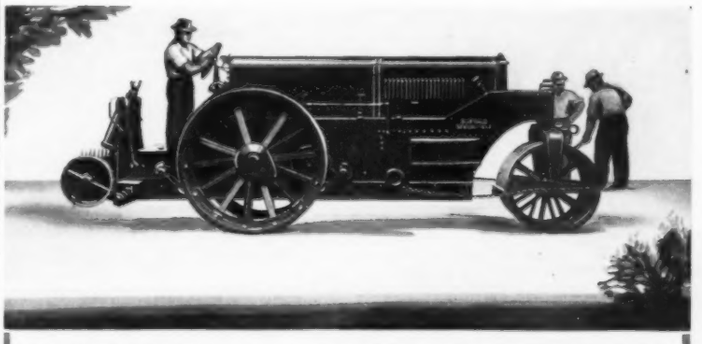

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The Good Roads Handy Sandy

Improved Handy Sandy Ready for Winter Work

With the problem of controlling sleet and ice on state and county highways not far away, the Good Roads Machinery Corp., Kennett Square, Penna., has announced an improved model of the Handy Sandy spreader for sand, chips, gravel, calcium chloride and cinders.

One of the features of the Handy Sandy is the revolving roll and wire brush control gate. The brush in the improved model contains 2,850 spring steel wires, all of which vibrate continually. The agitation thus created causes the material to flow smoothly and evenly through the spreader, according to the manufacturer. The flexibility of the wire brush gate permits oversize material and foreign objects to pass through without clogging. By a full range of adjustments, the Handy Sandy spreads any material from sand to 2-inch stone. A two-way clutch maintains the direction of rotation of the feeder roll, allowing the spreader to operate with the truck moving forward or backward. The dual wheels are equipped with pneumatic or solid tires.

Illustrated literature describing the Handy Sandy and other styles of Good Roads spreaders, all of which are suitable for year-round road work, may be secured by interested state and county highway engineers and contractors direct from the manufacturer or from this magazine.

New Compact Outfit To Clean Equipment

The Kerrick Kleaner, a compact all-purpose cleaning machine for all types of automotive cleaning, made by the Clayton Mfg. Co., Alhambra, Calif., produces an atomized vapor spray of hot water and soap at a uniformly safe temperature and with an instantly variable pressure to suit the job in hand. The spray is hot enough to clean the dirtiest surfaces quickly and, properly used, will not harm or burn the finest finish, according to the manufacturer. The chemically impregnated spray dissolves the dirt and grease, and the moderate pressure washes it away, leaving all surfaces clean.

Built in four sizes of stationary, portable and trailer models, the Kerrick Kleaner consists of an all-steel cabinet with removable body panels for easy accessibility to all moving parts and adjustment points. Within the cabinet is the new Kerrick positive-displacement belt-driven lifetime-lubricated ball-bearing pump; an automatic safety control to protect the plant against water failure; a heating unit for heating the cleaning compound solution; and solution concentrate tanks. Water is taken from the city or other water supply line. A full day's supply of Kerrick vapor-cleaning Kompound can be heated, dissolved and mixed in the machine at one time, eliminating delays for frequent soap mixing.

A 12-page bulletin, describing in detail the action of the Kerrick Kleaner and the various models available for cleaning trucks, parts and all types of equipment, may be secured by interested contractors and state and county highway engineers direct from the manufacturer by mentioning this item, or from this magazine.

Hot-Poured Compound For Expansion Joints

Thermoplastic rubber compound recently developed by Rubber Associates, Inc., 1790 Broadway, New York City, is designed to provide an elastic watertight expansion-joint seal throughout a wide range of temperatures, and has excellent adhesion to concrete, steel or bituminous materials.

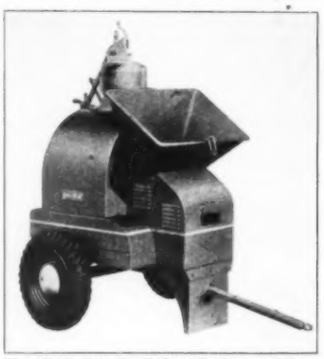
To prepare this compound, which is packed in 35-pound cores, for use, all that is necessary is to melt it to a fluid state in the same manner as that employed for asphalt, except that a temperature of 400 to 450 degrees F. is necessary before the material will flow freely. It is then poured into the expansion joint. Within about 10 minutes the material sets sufficiently to permit traffic to pass over it. Two consistencies of this product are available, one which sets up firmly for use in areas where high temperatures are encountered and one of a softer nature for use in climates where extremely low temperatures are encountered. For use in areas with a climate similar to that of New York, a mixture of the two is recommended.

Accelerated aging and durability tests, as well as field installations, seem to indicate a life of 10 years or better of efficient service for this material. A test installation in Massachusetts has survived two winters and three summers without being touched by a maintenance crew and shows no cracking at low temperatures or evidence of flow at high temperatures. This material is also recommended for use as a filler for maintaining and patching existing pavements, or for any form of expansion joint construction such as reservoirs, drainage ditches or swimming pools.

Further information on Thermoplastic rubber compound may be secured direct from Rubber Associates by mentioning this item, or from this magazine.

New Non-Tilt Mixer

The outstanding feature of the new 3½-S non-tilt mixer recently announced by the Kwik Mix Concrete Mixer Co., Port Washington, Wis., a subsidiary of the Koehring Co., is the absence of a drum ring gear, drum drive pinion and countershaft. Instead, the drum is driven



The Kwik Mix 3½-S End Discharge Mixer

by rubber drive rollers, keyed to the drive shaft which runs in anti-friction bearings. The rollers are driven by two steel roller chains direct from the engine. This feature is designed to reduce noise, vibration, and maintenance costs, according to the manufacturer.

Power is furnished by a Wisconsin air-cooled gasoline engine mounted close to the drum and completely housed, with ample air circulating openings. This engine has a built-in gear reduction, running in oil, and equipped with anti-friction bearings. A large gated hopper permits the preparation of a batch while another batch is being mixed. The gate swings into the drum with each batch, a tilted flow-line discharge chute increases the speed of discharge, and the end discharge is convenient for wheelbarrow loading. The shoveling height is low and the mixer can easily be handled by one man. The unit is mounted on two pneumatic tires and has a box-type welded steel plate axle of high strength to withstand all operating and travel shocks.

A new bulletin describing and illustrating the various features of this new Kwik Mix concrete mixer has just been issued by the manufacturer from whom copies may be secured by mentioning this magazine.

Pay-Roll Machine For Construction Jobs

Pay rolls on construction jobs vary considerably from week to week and the task of determining the exact denominations of bills and coins required from the bank consumes considerable time. In addition, the Social Security Act has placed an additional burden on pay-roll departments.

The Denominator, made by The Denominator Co., 261 Broadway, New York City, for making traffic counts and similar tabulations, is also available as a pay-roll machine. This new pay-roll Feathertouch Denominator is fitted with eleven keys, each designating a bill or coin from $20 to 1 cent. Each key controls and operates one of the eleven counting units contained in the machine. Each time a key is pressed, one unit is recorded. The indicating figures show the exact number of times each key has been pressed, and two or more keys can be operated at one time. After completion of any stated work, the total of each denomination is transferred to the currency slip which is an order forwarded to the bank for the currency required.

A bulletin describing this and other models of the Denominator may be secured direct from the manufacturer or from this magazine.

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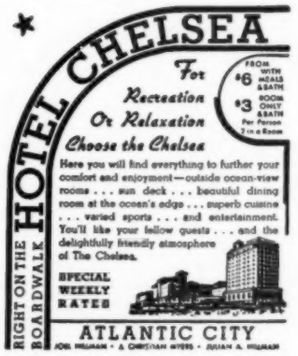
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SPECIAL WEEKLY RATES
ATLANTIC CITY

Open Dredge Caissons For Bridge Near Tacoma

(*Continued from page 26*)

chor is of solid, reinforced concrete, weighing 570 tons. They are 12 feet x 12 feet x 51 feet 6 inches in dimensions. They were cast on barges, towed to the site and dumped at exactly the right spots to form circles around the landing positions of the caissons. Two transit men were employed to line up a barge at the precise spot, communicating with each other by two-way radio sets. When the right position was attained, the barge was anchored and the sea cocks on one side opened, tilting the barge until the block slid off.

Steel cables 1 9/16 inches in diameter, rigged like bridles, fasten the caissons to the anchors, arranged with anchorline adjusting falls, so that tension can be increased or eased off by means of two electric winches at the top, drawing on the lower hitch of the bridle. As successive sections of the steel frame are built and concreted, the caisson sinks and these anchorage cables are also raised successively, deep sea divers going down and making the connections.

In the case of the east pier, the bottom of the channel was sloped at approximately 20 degrees. To get a level footing on which to land the caisson, the high side was excavated with a clamshell bucket working from the derrick of a dredging rig. With a tidal current of from 6 to 7½ miles per hour, the fines were largely washed off as the bucket came up. Working at a depth of 120 to 140 feet, even the larger boulders remaining in the bucket when dumped at the surface were swept beyond the excavation area before reaching bottom.

The east side caisson was landed early in May, while the caisson for the west side was placed in position in June.

Completion of Caissons

With the safe anchoring of the first caisson, work went on rapidly in completing it down to landing depth. A fender and working platform surrounds the caisson and floats independently of it. This fender is 7 feet wide, built of 12 x 12-inch timbers. A barge is tied up permanently at each end and anchored, while the concrete, steel and servicing barges draw up at the sides.

A concrete plant has been located on the west shore and all the concrete for the caissons is mixed there and transported in four 3-yard buckets by small barges. Here again, the swiftness of the currents made it too hazardous to locate the mixing plant on a barge at the site.

The steel goes up in 12-foot sections, followed by the concreting. In pouring the concrete, the derricks work 12 feet ahead, being raised by four winches to the successive levels. These winches are driven by electric motors of the same speed, all controlled by the same switch, so that in effect there is a synchronized lifting effort exerted on all four sides. The guy lines of the derricks are paid out from the same drums. The motors are 3 hp, each equipped with a 7,000 to 1 speed reducer.

The derricks for this work are of special design, built by the Star Iron Works of Seattle. The capacity of each is 45 tons, with 75-foot boom and 110-foot mast. Mounting the derricks on the caissons themselves, instead of floating them on barges alongside, is unusual, but the velocity of the currents made the customary method impracticable.

Cable Anchorage

In addition to the caisson work going on May 1, excavation for the east side bridge cable anchorage was nearly completed. This was a subcontract to Woodworth & Cornell of Tacoma, with R. E. Kendall, Superintendent. There were 12,000 cubic yards of excavation required, the cut being 70 feet x 170 feet and 27 feet deep. A Koehring ¾-yard gas shovel was used, the trucks going out over a steep ramp and depositing the material around the site to form the surface of the roadway around the toll plaza. This was leveled by means of a Caterpillar diesel Fifty, and afterwards compacted by a sheepsfoot roller. A 50-foot x 13-foot x 18-foot excavation was also made for the bridge abutment.

Personnel

The Narrows Bridge is being built by the Washington Toll Bridge Authority, for which Lacey V. Murrow, Director of the Washington State Highway Department, is Chief Engineer. Associated with him are Clark H. Eldridge, Bridge Engineer of the Highway Department, as Bridge Engineer and Charles E. Andrews, who supervised the construction of the San Francisco-Oakland Bridge, as Chief Consulting Engineer. For the contractors, known as the P. G. C., Ralph Keenan is Project Manager, Jack Graham, General Superintendent of the Pacific Bridge Co., is General Superintendent, and T. M. Kuss, Chief Engineer for the Pacific Bridge Co., is Chief Engineer. Construction on the Narrows Bridge started November 23, 1938, and the completion date is June 30, 1940.

Arc Welders Speed Work at Hansen Dam

Construction is progressing rapidly at Hansen Dam, the new 9,050-foot long earth-fill dam which will protect Los Angeles, Calif., from dangerous flood waters which sometimes sweep down the normally dry Tujunga Wash when abnormally heavy rains hit that region. An article describing the project and methods and equipment being used at Hansen Dam appeared on page 1 of the July issue of CONTRACTORS AND ENGINEERS MONTHLY.

As in any similar project, maintenance of equipment is a vital and ever-present problem. On this job the contractor uses considerable welding equipment to keep his tractors, shovels and other equipment in operating condition. Most of the welding equipment is in operation 16 hours a day, not only repairing heavy earth-moving machines as necessary, but also building smaller equipment, such as earth tampers and special tools, on the spot.

Included among the welding sets are nine General-Electric 400-ampere motor-generator units, and two G-E 400-ampere sets driven by Buda gasoline engines. One of the latter is equipped with a 1,500-watt auxiliary generator.

New Safety Hoist

A new 37-hp double-drum gasoline hoist, with a 4,500-pound single line pull at 160 to 195 fpm, has recently been announced by the Clyde Iron Works, Inc., Duluth, Minn. A steel housing that encloses all moving parts, preventing accidents and keeping the cable from being entangled in the gears, provides safety from every angle, according to the manufacturer.

Smooth effortless operation of the hydraulic band friction results in greater production and less operator fatigue. All operating levers are conveniently grouped at the operator's comfortable adjustable seat. Other features include the grease-packed life-time ball bearings; improved ball-bearing cam-operated brakes; one-piece all-steel frame; skid-type base for portability; ample waterfall of drums with easy visibility of the cable from the operator's seat; steel gears with machine-cut teeth and chain drive run in a bath of oil; drums with turned barrels and improved cable anchorages; and polished winch heads.

The New Clyde Double-Drum Enclosed Safety Hoist

Complete information on this new Clyde safety hoist may be secured by those interested direct from the manufacturer or from this magazine.

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State Roads Cleared Of Snow by Contract

(*Continued from page* 18)

likely to obstruct the road, the Maintenance Division makes use of snow fence to arrest the drifting. These fences are made ready and stored at maintenance stations in the neighborhood, and the placing and removing of the fences are commonly done by the regular force of the Division. The snow fences vary in length from 50 feet up, their extent depending upon the length of the cut.

Snow fences are erected as late as possible in agricultural districts but somewhat in advance of the first snow, and are removed early enough at the close of winter to avoid interfering with the cultivation of lands flanking the highways.

The preparatory overhauling of snow fences, like the maintenance work on all of the equipment owned by the State Highway Department, is taken care of in the Department's shops and by its regular force.

Preparing for Snow

Overhaul and repair work goes on continuously, and the different types of maintenance operations are taken in hand as circumstances permit. As a rule, the Maintenance Division has everything in readiness for its winter activities by December 15, and from that date it is prepared to deal with snow and ice until the following April 1. Nature, however, does not always work on schedule, and there may be troublesome snowfalls several weeks earlier than December 15 and even later than the closing date assumed for winter operations. Twice, as the records show, the Maintenance Division has been caught at a disadvantage by belated snowfalls; once on the first of April and another year on April 11. Those falls were fairly deep and the snows were wet, and they proved very troublesome.

To anticipate the approach of troublesome storms in the winter, the State Highway Department headquarters in Trenton maintains constant touch by telephone with the U. S. Weather Bureau, the airport at Newark, N. J., the weather service in Philadelphia, the Pennsylvania Railroad offices in Trenton, and the Transcontinental Western Airways headquarters in Newark. This network of communication makes it possible for the Maintenance Division to keep informed night and day and, to a considerable degree, to anticipate the coming of a snow storm and to be ready to deal with it with dispatch.

Work starts as soon as the storm starts, and it frequently happens that half of the roadway may be cleared as the plows advance along one side, only to find the same area covered deeply by the time the plows are making the reverse trip on the other half of the highway.

Organization

The snow-removal organization is composed primarily of the headquarters staff in Trenton where the Superintendent of Maintenance or one of his aids is on duty and accessible by telephone at any time of day or night; and headquarters, in turn, keeps in touch with the field superintendents directly in charge of snow removal within the 132 sections into which the state highway system is divided. There are 110 of these superintendents, any one of whom can be reached by telephone at any time. In addition to the superintendents, there are assigned to each highway section one or more Department representatives, and these men are the field officers who supervise all operations in connection with the actual work of snow removal and ice control. The superintendents

One of the Lighter Trucks Equipped With a One-Way Plow Handling a Fall of Dry Snow in the Coastal Section on a New Jersey State Highway

and their associate Department representatives reside near their respective assignments.

The 132 subdivisions or highway sections range in length from a minimum of 4.515 miles to a maximum of 29.31 miles. The shorter sections are adjacent to populous areas, and usually carry heavy volumes of traffic, where speed in clearing the highway is of prime importance. On the longer sections, travel is not so heavy and snow removal can be carried on at a somewhat slower pace.

Snow Removal by Contract

Of the 132 subdivisions of the state highway system, snow removal is handled directly by the State Highway Department in only 33 of these sections, while the removal of snow in all of the others is entrusted to a corresponding number of contractors. Generally speaking, the contractors furnish the motor trucks required for the service, and the department provides the plows or rotaries, as the case may be. Between the limiting dates of the snow removal season, the contractor must have his agreed-upon equipment available and fit for service, and a mechanic at his disposal. He must be ready, day or night, to move on to the job whenever the Department representative gives the word. The contractor can start only when ordered, and the representative also orders the contractor's force and equipment to return to the contractor's base at the conclusion of the job.

The arrangement with each contractor is broadly on a percentage basis of compensation for the work involved, but there is a separate arrangement for a fixed fee for the contractor's foreman, the use of the contractor's equipment, and a specified allowance for ballast to weight the contractor's trucks so that they will be able to push the plows into the snow. Actual service starts only when the contractor is notified to stand by with his men and equipment ready to go out on the road when the Department representative gives the word; and the compensating period covers the time consumed in actual snow removal and the return of the men and equipment to the contractor's station or yard.

Each contract specifies that the contractor shall have available for service the required equipment of named types and the necessary force to operate that equipment efficiently. The provisions are such in all of the arrangements as to assure a reasonable degree of flexibility to meet variable conditions. Broadly stated, the contractor for each section is required to have at his disposal three trucks of sufficient capacity to push the three plows that are provided by the State Highway Department. The trucks in service are of many different makes and rated capacities, and are commonly of the four-wheel-drive type. Ten-ton tractors are invariably used to push the rotaries. The plows employed may be either a V-type or one-way plow, the choice being determined by local needs and the average depth of snowfall that has to be removed from that section.

The Department owns and operates with its own force four tractor rotaries, three tractor-mounted pusher plows, and six heavy-duty truck rotaries. These machines are kept on certain of the heavily traveled traffic arteries, located at points throughout the state where their services have been found indispensable in dealing with heavy snowfalls quickly and effectually.

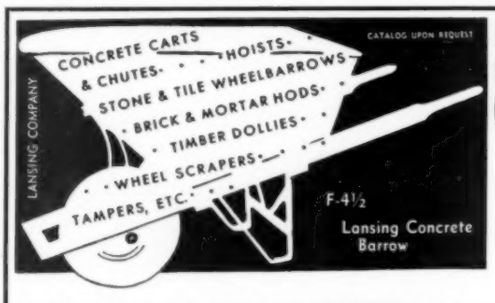
Costs

In the last analysis, highway officials as well as the public are interested in what it costs to remove snow from a state highway system. The costs given here for snow removal and ice control in New Jersey include an allowance for depreciation of equipment. This is not always included by states in the computation of their snow-removal costs.

COSTS OF SNOW REMOVAL AND ICE CONTROL IN NEW JERSEY

Winter Season	Total Cost	Number Of Miles	Cost Per Mile
1924-1925	$223,117.95	815.641	$273.55
1925-1926	259,280.25	814.310	318.40
1926-1927	181,700.39	870.285	208.78
1927-1928	138,404.27	898.764	153.99
1928-1929	113,649.15	961.524	118.20
1929-1930	101,804.64	1,112.769	91.49
1930-1931	101,061.86	1,258.002	80.34
1931-1932	54,383.29	1,361.279	39.95
1932-1933	155,617.99	1,419.244	109.65
1933-1934	495,699.63	1,459.978	339.53
1934-1935	472,559.06	1,512.665	312.40
1935-1936	534,655.91	1,548.781	345.21
1936-1937	176,920.82	1,572.241	112.53
1937-1938	199,766.44	1,597.650	125.04

The concreting plant for the first stage of Marshall Ford Dam in Texas, the aggregate plant for which is described in this issue, will be described in detail in our November issue.



EQUIPMENT FOR CONTRACTORS

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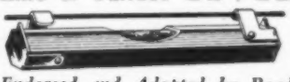

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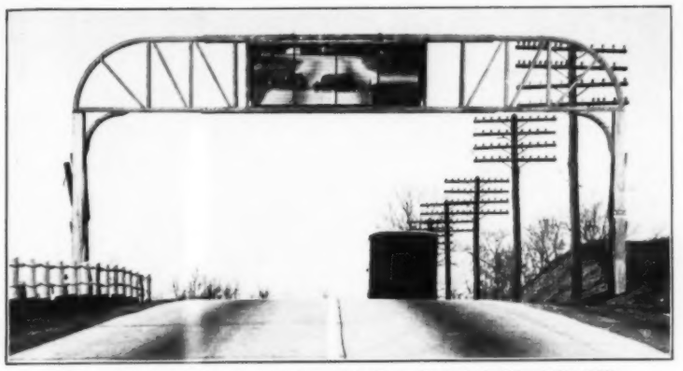

The Traffiscope Indicates to Drivers What's on the Other Side of the Hill

New Overhead Device For Safety on Hills

One of the important causes of traffic accidents is lack of sight distance, and one of the places along the highways where it is often most expensive or practically impossible to increase sight distance is on hills. The purpose of the Traffiscope, a new scientifically designed highway safety device made by Traffiscope, Inc., 2500 Rand Tower, Minneapolis, Minn., is to permit drivers of cars going up hills to see what is beyond them over the crest of the hilltop.

This is accomplished by means of a prismatic lens, mounted in an overhead frame at the apex of a highway hillcrest, in which the driver sees an image or picture of the highway beyond the summit of the hill. Through this lens the sight line of an approching driver is refracted downward onto any vehicle or other object which is concealed by the summit. The lens itself is made up of a series of relatively small oblong glass prisms mounted one above the other, each one being so proportioned that the lens as a whole gives an unbroken picture of the scene ahead. The angle of necessary refraction and other dimensions for the most efficient operation of the Traffiscope are determined by the field conditions at the site. The width of the lens is obtained by placing prisms of identical form end to end and the height is secured by the number of prisms mounted vertically. Thus, by assembling the component parts of the lens, any desired width and height may be secured. In order to present a full perspective of the hidden length of the road, a slight cylindrical curve is ground on one side of each prism. This flattens the scene behind the hillcrest, eliminating the necessity for excessive lens height, but does not, according to the manufacturer, interfere with normal judgment of the distance to any object seen in the lens, as the image is not modified horizontally.

One of these Traffiscopes has been installed at the crest of a hill on U. S. 5 near Hartford, Conn. A careful study of drivers' reaction to this new device has been made and the results compiled and published in a 28-page booklet. The consensus of opinion, based on this study, seems to be that there is no hazardous confusion created in the minds of drivers seeing a Traffiscope for the first time, and that, after using the Traffiscope and understanding its purpose, drivers place substantial value on the ability to see what is over the crest of the hill.

Although only a limited number of copies of this study of drivers' opinions of the Traffiscope is available, interested state and county highway engineers may secure copies by writing direct to the manufacturer and mentioning this item.

New 2-Yard-Shovel Bulletin

A complete description of the new Bucyrus-Erie convertible 44-B 2-yard shovel is contained in a 32-page bulletin recently issued by the manufacturer. The features of the machine are fully explained, with illustrations to show the structural and mechanical details.

Copies of this Bulletin No. 44-B1 may be secured direct from the Bucyrus-Erie Co., South Milwaukee, Wis.

Measures to Provide Loans for Road Work

Before adjournment of Congress, Senator Carl Hayden and Congressman Wilburn Cartwright introduced companion bills, S-2974 and H. R. 7533 respectively, to assist the states in the improvement of highways. These bills direct the Commissioner of Public Roads to cooperate with states, municipalities and other public bodies in providing an appropriate and economical means for facilitating the construction, reconstruction and improvement of post roads, highways, parkways, streets, grade crossings, grade separations, bridges, viaducts and tunnels, including crossings over or under navigable waters, and works incidental thereto. These measures further authorize the Commissioner of Public Roads to acquire rights-of-way but not until a contract has been entered into with a state, municipality or other public body to repurchase such right-of-way.

The Reconstruction Finance Corp. is authorized to make loans to finance or aid in financing such road projects and the acquisition of real property or interest in property necessary or desirable for or adjacent to such projects; the loans to be made after approval by the Commissioner of Public Roads of plans and specifications for such projects submitted by states or other public bodies, and upon such terms and conditions as will reasonably assure the repayment thereof within 40 years, with interest at rates that may reasonably be expected to reimburse the R. F. C. for the cost to it of the capital required for the loans.

In order to effect the recommendations of the Public Roads Administration for the relief of highway traffic congestion, two important steps are necessary: first, surveys and plans; and second, acquisition of rights-of-way and loans. The legislation for surveys and plans was enacted in Section 2 of Bill S-1109 and the acquisition of rights-of-way and construction is taken care of in these new bills through loans to the states or other subdivisions.

Highway leaders in Congress are reported by the American Road Builders' Association to be of the opinion that, with these bills already introduced, there will be ample time between now and the next regular session of Congress for the careful study of the measure and, at the same time, the various state highway departments will have an opportunity to make plans for their respective programs which might be carried out under such an Act.

This legislation is separate and apart from regular Federal Aid and will not in any way jeopardize future Federal Aid legislation.

LeTourneau Dedicates New Georgia Factory

On July 11, a new, all-steel, electrically welded factory building, located on a 2,000-acre tract of land a few miles from Toccoa, which will house the new LeTourneau Co. of Georgia, was dedicated by R. G. LeTourneau. This new $2,000,000 plant is to be used in the manufacture of the huge Tournapull, the most recent addition to the line of dirt-moving equipment made by R. G. LeTourneau, Inc., of Peoria, Ill., and Stockton, Calif.

The new plant is modern in every respect. Every section of the 400 x 400-foot factory is served by jib cranes. Shipping facilities are so arranged that all machinery can be loaded and unloaded without lifting, as a railway siding has been built at floor level.

More than 5,000 people attended the dedication ceremonies, including such notable visitors as the Hon. E. D. Rivers, Governor of Georgia, and U. S. Senator Richard B. Russell, Jr.

SALES VERIFY ADVANTAGES OF TAPERED MONOTUBES

● 528% sales increase, 1935-1938! It took a lot more than improved business conditions to bring about such an increase in four short years. The answer is ENGINEERING ACCEPTANCE resulting from actual experiences proving both the superior structural strength and economy of Monotubes.

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BURCH CHIP-IT-OVER

Saves money and material both Summer and Winter. Use for sanding icy roads and streets or for seal coating and re-surfacing. Independent motor controls width and depth of spread.

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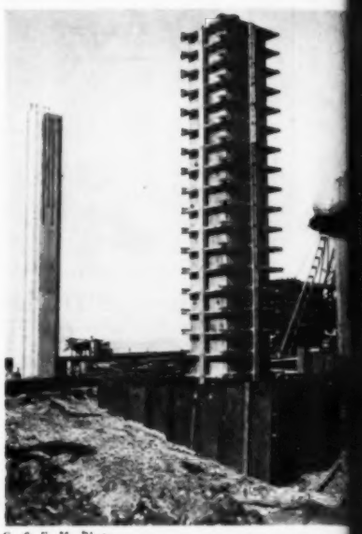
The Method of Handling the 40,000-Cubic Yard Slide Which Developed During the Daylighting of the Old Newhall Tunnel, Part of a Widening and Paving Contract on U. S. Route 99 in California. The Top Photograph Shows the Upper Limit of the Slide in the Background at the Left, While the Center Photograph, Taken from the Upper Portion of the Slide, Shows the Power Shovel Working Below. At the Bottom, Two of the Griffith Co.'s Trucks Being Loaded at the Bottom of the Slide. See Page 2.

Counties in the Northern States Have Been Preparing, During the Past Month, for the Maintenance of Their Roads for Winter Traffic Through Snow Removal and Ice Control. Here Is an Allis-Chalmers Speed Patrol with a Baker Snow Plow Which Has Plowed More Than 20,000 Miles of Road for Sherburne County, Minnesota.

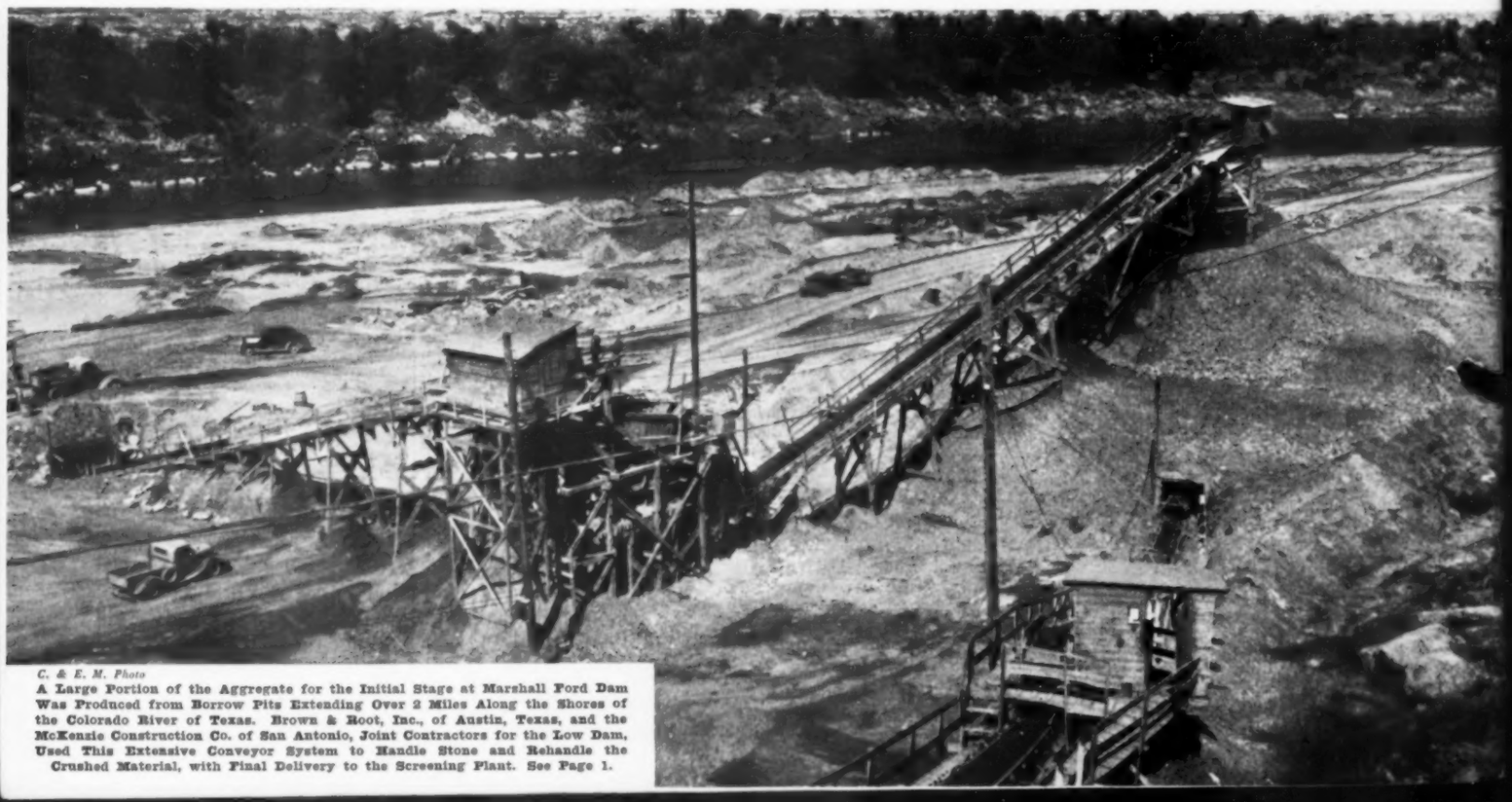
Three International Tractors with 7-Foot Cutter Bars Mow Both Sides of 1,000 Miles of Florida Highway, As Well As 960 Acres in Twelve Airports, Three Times Each Year.



C. & E. M. Photo

A Progress Photograph of Work at a New Highway Overpass in Texas, Showing a Column Ready to Be Poured, Another Curing and, at the Left, A Completed Column. See Page 2.

A Scene at the Narrows Bridge, Tacoma, Wash., Showing the Method of Sinking the Caissons. Note the Floating Fender Used for a Working Platform and for Mooring Barges. See Page 26.



C. & E. M. Photo

A Large Portion of the Aggregate for the Initial Stage at Marshall Ford Dam Was Produced from Borrow Pits Extending Over 2 Miles Along the Shores of the Colorado River of Texas. Brown & Root, Inc., of Austin, Texas, and the McKenzie Construction Co. of San Antonio, Joint Contractors for the Low Dam, Used This Extensive Conveyor System to Handle Stone and Rehandle the Crushed Material, with Final Delivery to the Screening Plant. See Page 1.

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